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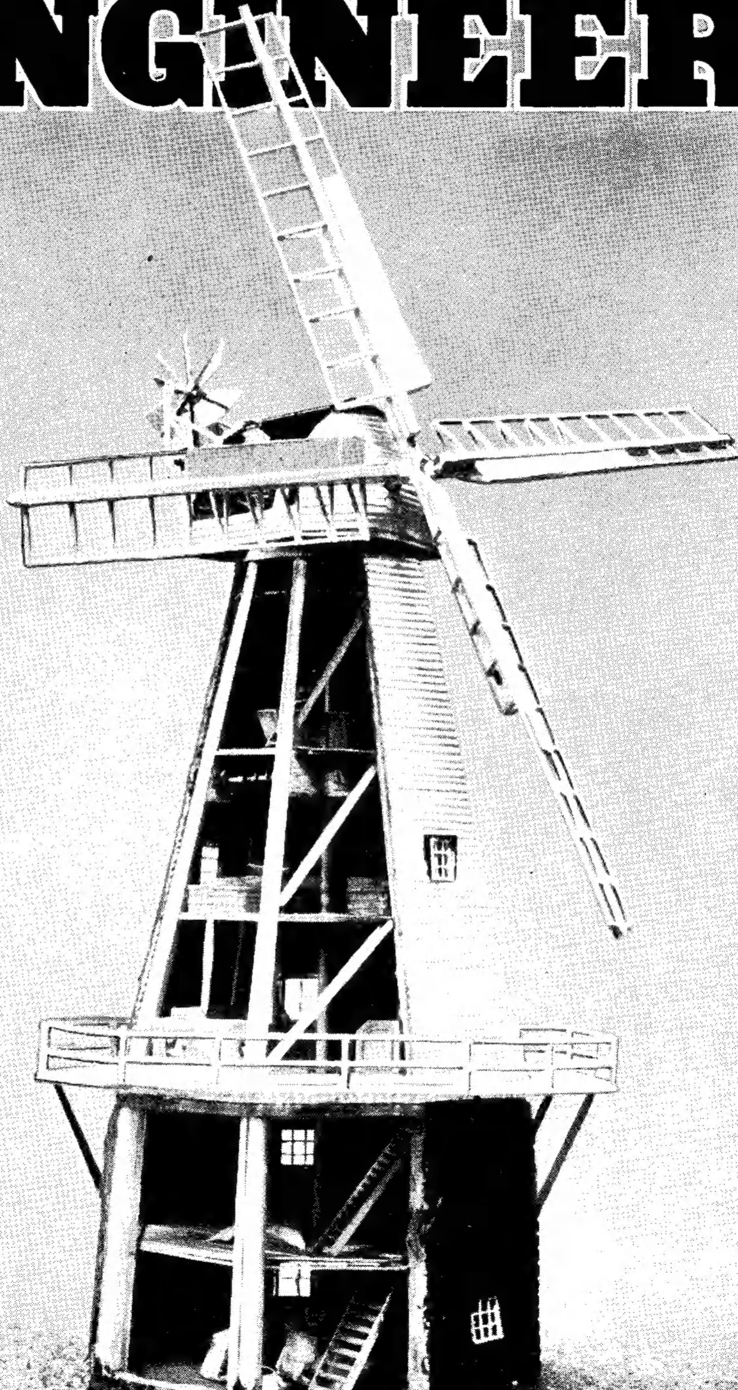
THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

11TH OCTOBER 1951 VOL. 105 NO. 2629

SMOKE RINGS

Our Cover Picture

● THE SCALE model of a Sussex windmill shown in this photograph was constructed by Mr. D. A. Dubbin, of Fulham, and awarded a Very Highly Commended diploma at this year's "M.E." Exhibition. Apart from being a very realistic representation of the actual mill at Rye, from which it was copied, it is partly sectioned, and fitted internally with machinery and furnishings on all floors. The perpetuation in model form of these once familiar, but now fast disappearing, landmarks is a worthy outlet for the talents of model engineers; not only their architecture, but also their mechanism, are of a unique and interesting type, which has fostered a class of craftsman—the original millwright—whose skill and resource should not be allowed to pass into oblivion. Mr. Dubbin has made a special study of this class of model work, and the model of Silverhill mill at St. Leonards, which he exhibited at last year's "M.E." Exhibition, and which was also awarded a V.H.C. diploma, formed the subject of our cover picture for the issue dated October 5th of that year.

The Permissible Touch!

● A RATHER interesting tit-bit attracted our attention the other day in the editorial columns of a well-known weekly. The editor had apparently been a visitor to the "M.E." Exhibition and had been listening to the broadcast requests to visitors to refrain from touching the models. Within a few moments of one of these broadcasts, he came across a man running his hands over a large model aeroplane on the R.A.F. stand, while the uniformed R.A.F. attendants stood calmly by, sympathetically watching him. It was not until some moments elapsed that the editor concerned realised that the apparent transgressor was blind!

Few readers, we think, realise how many of our blind friends visit us every year, and the great interest they display in the models is ample proof of their uncanny ability to assimilate even the most delicate details, merely by touch.

Musical Boxes

● AS A result of the "Smoke Ring" on this subject in the issue dated September 13th, 1951, we have received some correspondence from a number of interested readers, all of whom appear to be suffering from the same difficulty—how best to replace bent and broken pins on the cylinder, and what material? We feel sure that some one of our readers must know the answer and would be only too pleased to communicate their experiences in this direction to fellow readers. What about it, music boxers?

New Exhibits at the Science Museum

● TRUE-TO-SCALE models of modern agricultural machinery and implements exhibited against scenic backgrounds in diorama form have been used in the Agricultural Machinery Collections, officially opened recently by the Minister of Education (Rt. Hon. George Tomlinson, M.P.) at the Science Museum, Kensington. Situated in a newly-built wing, the collections, including the dioramas and models, will be a permanent part of the museum.

The majority of the models were made by the Design and Display Division of A. E. L. Mash & Associates. Nearly a hundred are on view, all constructed to a scale of 1 in. to a foot, and they are displayed against scenic backgrounds with plaster bases, illustrating the work of the up-to-date mechanised farm throughout the seasons of the year. Twenty firms have contributed the models, including the David Brown Tractor Group, Harry Ferguson Ltd., and the Ford Motor Company.

Every aspect of modern developments in agricultural machinery is displayed in the exhibition with realistic dioramas showing different types of agricultural vehicles in action. Human figures assist in conveying the scale of the model. One illustrates the Fordson tractor built in 1917 which played a big part in helping home food production during the first World War. The Fordson diorama is the fourth in a series illustrating medieval ploughing, horse ploughing, steam ploughing of ninety years ago, and the tractor plough.

Plaster bases and scenic backgrounds have been used in the modern section where the highlight is 15 colourful dioramas depicting farming throughout the seasons. Built to a 1/12 scale, the dioramas show muck spreading, tillage work and root harvesting in the autumn, planting and silage making in the spring and haymaking, harvesting, threshing and crop-spraying in the summer and winter seasons.

Problems had to be overcome by the Museum authorities in the adaptation of an artificially-lit series of exhibits to a modern style presentation. Planning was necessary where cross-reflections might occur and much thought was given to lighting intensities. Fluorescent lighting is used in the display cases, which have a pleasing frontage of elm-faced plywood and are of the "shop-window" type, built into the panelling of the walls and protecting spars. The windows of the cases are sloped to avoid the cross-reflections of light. Restricted space in the section has made it possible only to cover the methods of arable farming. The display was planned in close consultaton with the Ministry of Works, who were responsible for design, provision, building and lighting of the display cases.

Design and construction of the models were carried out in the model-making workshops at Wimbledon while the dioramas were planned, designed and produced in the display studios at Putney. The model-making workshops and the display studios are under the direction of Mr. John A. Drury, formerly with the B.O.A.C. Display Division.

The workshop's staff, which includes a number of ex-servicemen, was fully engaged for several months in producing the scale models of tractors, threshing machines, muck-spreaders and harvesters, for they had to be accurate in every minute detail.

Extensive research by the Public Relations section of the A. E. L. Mash & Associates organisation was necessary to ascertain and place at the disposal of the associate companies the technical detail vital in the construction of scale models and dioramas. Special visits were made by the Public Relations staff to various libraries, institutions and agricultural machinery manufacturing works all over the country. Co-operation was also obtained from the Imperial War Museum and numerous other official organisations.

An M.E. Trio

● WE RECENTLY had occasion to visit an exhibition in the South where the championship cup was awarded for a model of such an intricate subject that it was obvious that a great many hours were put in weekly. On being introduced to the craftsman, we commented on this and asked, guardedly, how he managed to evade marital discord.

"Oh! I don't get any of that," replied our new-found friend, "all the family are model engineers."

On consulting our judging forms, we found that his wife had received an award and his 14-year-old daughter had produced one of the most superb exhibits in the handicrafts section.

What a truly lucky man and what a delightful working combination!

News from New Zealand

● WE HAVE received a long and interesting letter from Mr. L. G. Callis, who is now settled in New Zealand, having moved there from his former home at Ruislip in August, 1950. And it all came about through an article of his published in THE MODEL ENGINEER in January, 1949! In that article, he had invited any readers to write to him if they wanted any more information concerning a petrol engine modification he described; he received one letter, and it came all the way from New Zealand!

Much correspondence subsequently passed between Mr. Callis and his unknown friend 12,000 miles away, and eventually led to Mr. Callis and his family travelling that distance to a new home where they are now happily settled.

Model engineering activities were soon begun and Mr. Callis has joined the Waikato Society of Model Engineers, who, with the Hamilton Model Aero Club, recently held an exhibition in the Art Gallery, Hamilton. Mr. Callis entered his fine Westbury "Atom V" petrol engine, and had the honour and satisfaction of being awarded the Championship Cup!

He tells us that, on the west side of Hamilton, there is a beautiful lake covering some 40 acres, and the City Council has granted part of it for the running of model power boats; Mr. Callis adds:—"The trouble is that I have landed in a locomotive stronghold and will have to work hard to gain some power boat converts." We think he will do it and achieve his object.

THE SWISS INTERNATIONAL REGATTA

by George Stone

THE outstanding feature of the Swiss International Regatta, 1951, was the fine performance put up by Dick Phillips with his home-built engine. This made a profound impression with the Continental boys, to them a high performance 10-c.c. racing engine could come only from the home workshop of the old maestro, Gems Suzor.

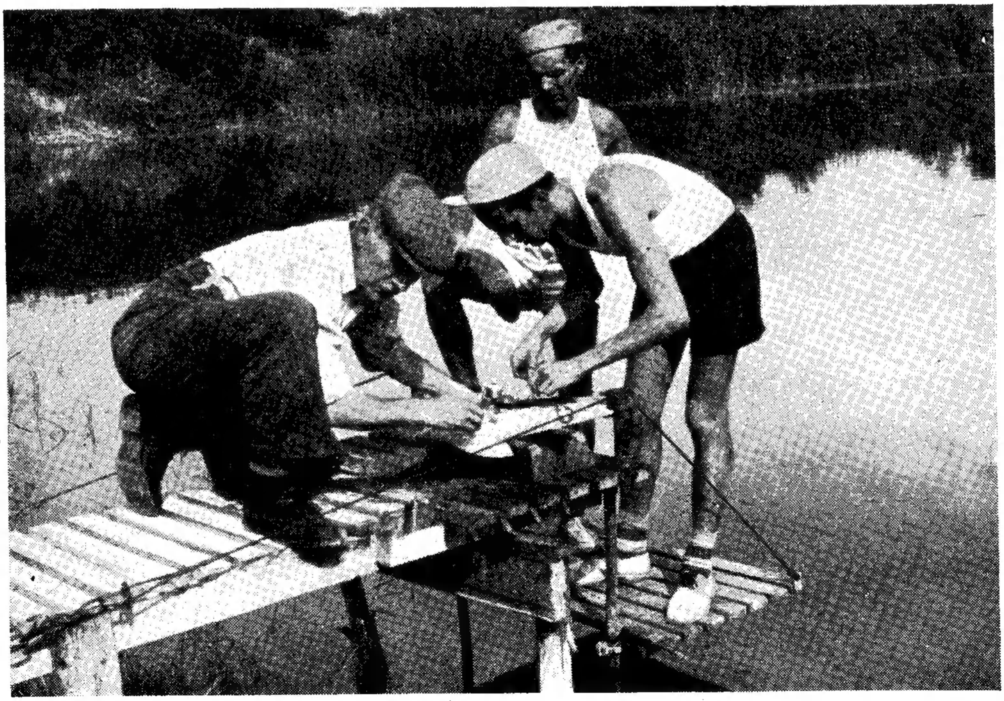
By his skill, hard work and ingenuity, Dick has achieved results that, apart from settling the argument of home-built v. commercial engines, have raised the prestige of British model engineering very high. His 69 m.p.h. with a home-built 10-c.c. engine is, in my opinion, one of the best performances anywhere.

As on a similar occasion two years ago, the Swiss boys made us very welcome; their kindness and hospitality will be a very happy memory. The organisation of the actual contests was carried out with precision and perfect harmony.

The electric timing gear, made in the famous Longines factory, is a lovely example of Swiss watch engineering; its technical features are too involved for me to describe in detail. Working in conjunction with this is a " time-on-the-line " clock, having a large dial divided into three minutes and graduated into seconds; when your allotted time has expired, a bell rings.

The race for the Ford Mecanic Cup was held on Saturday afternoon. The weather was very hot, the water calm. Dick and myself decided to run strictly under M.P.B.A. rules, with silencers and knock-off switches.

After some very exciting and interesting racing, my *Lady Babs II* recorded the highest speed, followed very closely by that good sportsman, Pierre Chevrot, only three-quarters of a mile separating our boats; third place being taken by Henri Barraud, registering his first success in international racing. Henri is very popular,



The Chevrot family. Papa helps Pierrot start " Be Bop II," while Jean-Louis looks on. A happy and successful team

M.R.C. stand at Geneva exhibition. A fine collection of speedboats and photographs. The famous Hispano Suiza cup decorated with M.R.C. colours stands in the centre

George Stone filling up "Lady Babs II"

and his well-deserved success comes after seasons of hard work and lots of bad luck. Dick Phillips was fourth, both he and myself setting up new British records.

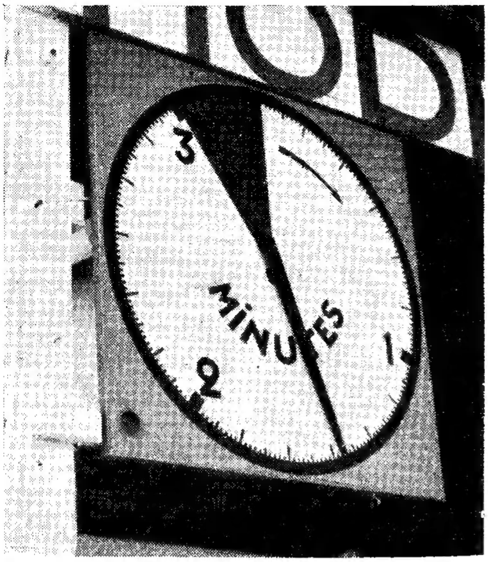
On Sunday, the race for the Hispano-Suiza Cup started at 8.30 a.m., a slight wind leaving a ripple across the water. The same keenness was shown by all competitors, and the large crowd of spectators again witnessed some exciting racing. Dame Fortune again smiled on me, and only one start was required for *Lady Babs II* to record a speed of 121.7 k.p.h. (75.57 m.p.h.). Henri Barraud was second with 112.3 k.p.h. (69.77 m.p.h.) and Dick Phillips third, 110.4 k.p.h. (68.57 m.p.h.). My speed was a record for the event and broke the British record set up on Saturday.

After a most enjoyable lunch, and a greatly appreciated exhibition of Swiss folk dancing by Dick and Mrs. Phillips, the final race, that for the M.R.C. Cup, was held.

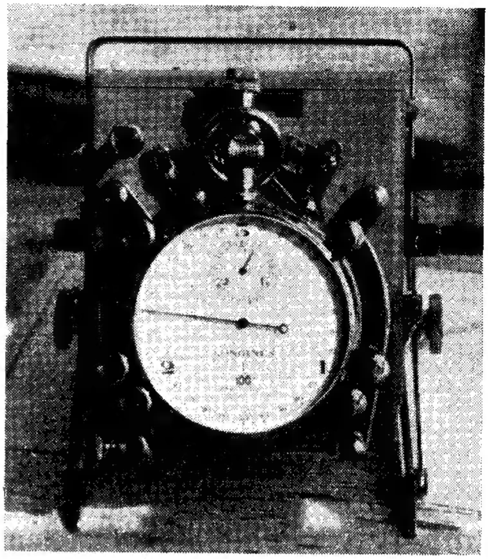
By this time those elusive little men with pointed ears " the Gremlins " began to take over and only five competitors returned times.

Pierre Chevrot emerged a popular winner with a speed of 108 k.p.h. (67.5 m.p.h.), Henri Barraud again was second, and Jean-Louis Chevrot, third, Dick and myself being among those unable to get away.

Although that hard-working president of the



The massive time on the line clock. Clearly visible by competitors

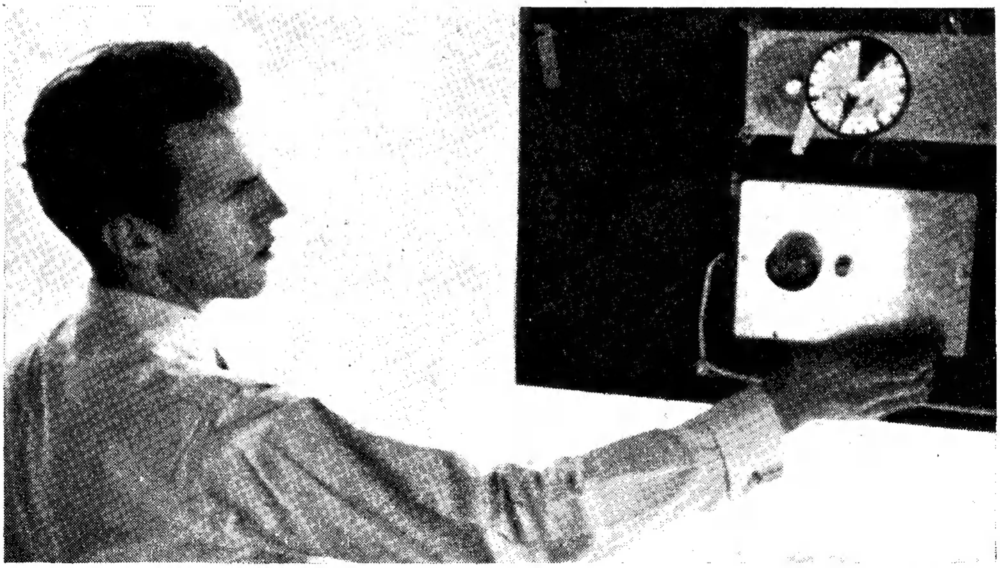


The magnificent Longines 1/100 sec. chronometer, electrically operated

M.R.C. did not produce the speeds of which we know him to be capable, I am sure that Jean-Louis Chevrot will again be our most formidable rival when we entertain the Continental boys next year.

In conjunction with the Hispano-Suiza and Ford Cup races, it would be a good idea to run an international straight-running contest for a perpetual trophy. This, and a repetition of that wonderful Class "A" race at St. Albans by the "old masters" should prove to be an interesting addition to the Great Britain v. France and Switzerland series.

For me, the past two years since "Swiss International Regatta, 1949" have been an interesting and instructive period of trial and error, of changing luck, a new understanding of the spirit of M.P.B.A., absorption of useful and constructive criticism, and thankfulness for help and kindness received.



Pierrot Chevrot, popular host to British team, switches on time on the line clock. A synchronised replica of the large one

AN EXPERIMENTAL STEAM TURBINE

by J. A. Bamford

IN September, 1949, I visited a model power boat regatta and being very thrilled by the speed and antics of the boats, resolved to build one for myself. I chose steam as a means of propulsion because it has always fascinated me, and more important, it scored on the side of quietness. I consider noise most undesirable, especially when the model has to be run within earshot of non-enthusiasts. However, the piston engined flash steamers were also fairly noisy, so I said to myself, why not a turbine? I was fully aware that a number of model turbines had been made, but I had never, that is up to then, seen a really serious attempt to produce one that had some real power in it; I decided to have a go!

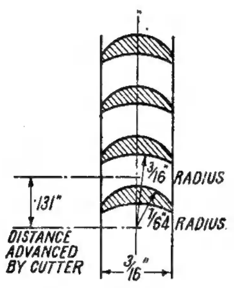


Fig. 1 Dimensions of turbine blades

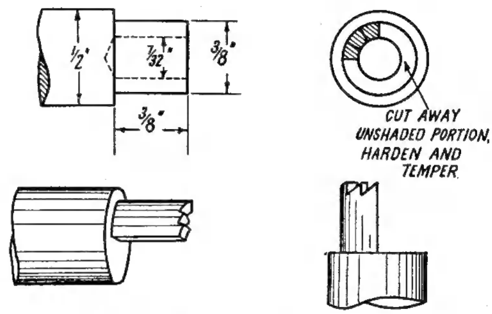


Fig. 2 Details of blade cutter

Some Thoughts on Design

The first job was to decide on the size of the wheel, the power I expected to get out of it, the speed to run it at and the gear ratio to bring it down to something useful. I delved into a lot of steam turbine books and found that 4,000 ft./sec. was a good average of steam speeds to be expected in a De Laval nozzle. Now I did not for one moment expect to get this, so I halved it and said, "I shall get 2,000 ft./sec. at my nozzle exit." I also gathered in my studies that the blades on the wheel should travel at approximately half steam speed, that brought me to 1,000 ft./sec. A wheel having a circumference of one foot would, therefore, revolve at 60,000 r.p.m. This sounded a bit high at first, but I got used to the idea and decided that allowing a bit for losses, my wheel should be about $3\frac{1}{4}$ in. diameter, this being a convenient size to house in a boat. The next thing to decide was the ratio of the reduction gear. I had seen figures quoted for some well-known American engines, of 20,000 r.p.m. These engines were very successful in the "C" class, but were also well known for the difficulty of starting the boat. With this in mind I reduced my target propeller speed to 15,000 r.p.m.; obviously a gear ratio of 4 : 1 was wanted.

I then turned my attention to boiler design, and remembered seeing some figures quoted in THE MODEL ENGINEER of over 1 pint per minute being evaporated at 500 lb. per sq. in. I took this with a pinch of salt, but even then it meant about 20 theoretical h.p. was available; I thought that I might get 20 per cent. efficiency from the turbine, and four horse-power would be enough to give the power boat boys a shock, but alas! It was not to be.

Blade Form

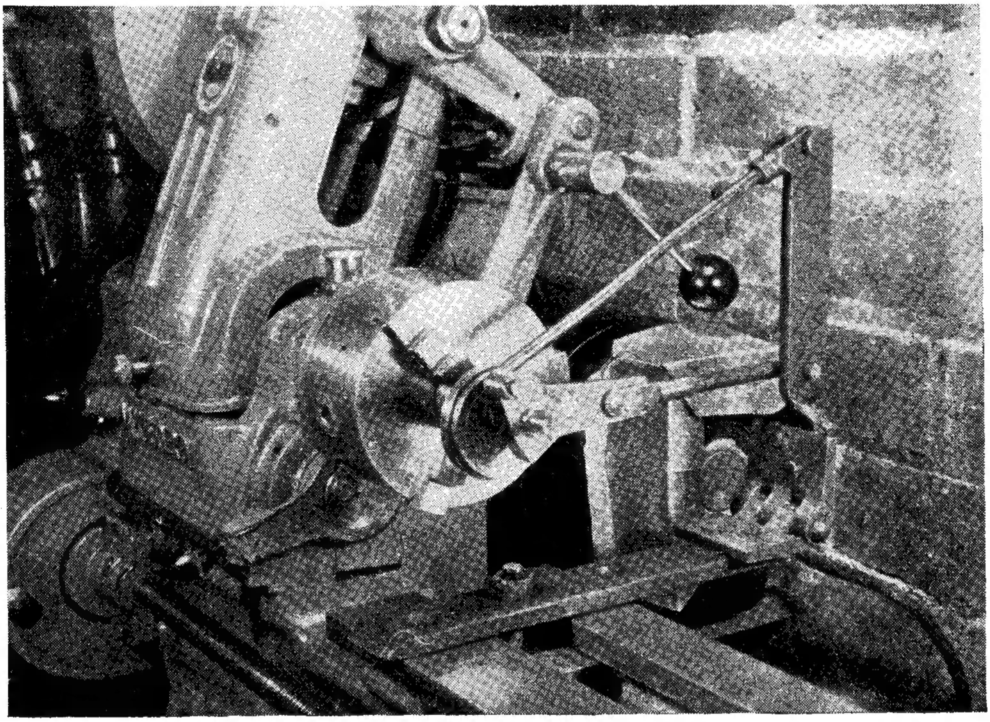
With these astronomical figures in my head, I decided I could not begin too soon, so I began thinking up a method to cut the wheel blades. I rejected the method of brazing on preformed blades as too fiddly and not strong enough. I recoiled from the idea of making a pantograph miller (I had not read Mr. Chaddock's grand articles then), and one way or another I was at a dead end. Then, several days later I had an idea. I had been reading the articles by "Duplex" on gear cutter generation, and I suddenly realised that the mechanism for imparting a rocking motion to the cutter, could be modified to cut blades having their front and back surfaces composed of circular arcs.

I will now get down to brass tacks and describe the construction of the plant, together with the attendant snags. The first thing to make, of course, was the wheel, and a width of $\frac{3}{16}$ in. was decided on.

The theory behind the cutter is this: a hollow end-mill with three-quarters of its circumference cut away, oscillates against the edge of the disc. It thus cuts a radial slot with its sides of different curvature, according to the inside and outside diameters of the cutter. I quite realise that this is not an ideal theoretical shape, but it is a real mass production method.

If a little, suitably scaled up, experimental drawing is done, it will be found that the inside diameter of the cutter must be a little greater than the wheel width. The outside diameter and

the spacing of the blades is adjusted till the trailing edge of the blade is thin without being mechanically weak. Fig. 1 shows how this came out in my case, the internal diameter of the cutter being 7/32 in. and the outside diameter $\frac{3}{8}$ in., for a wheel $3\frac{1}{8}$ in. diameter having 75 blades. Fig. 2 shows the details of the cutter, which was formed on the end of a 13 in. length of $\frac{1}{2}$-in. silver-steel. The cutter operating gear consists of a piece of MS bar 1 in. in diameter $2\frac{1}{2}$ in. long, which has a hole bored and reamed $\frac{1}{2}$ in. diameter right through. On the end of this is pressed or attached in some way an eccentric, the strap of which is connected to a vertical rocking lever which is attached by a hinge to the lathe bed. From this rocking lever a rod is taken to a small arm, clamped to the $\frac{1}{2}$-in. silver-steel rod which has its bearing in the 1 in. diameter MS rod. It will be seen that when the lathe is set in motion, an oscillating motion will be imparted to the cutter which is co-axial with the lathe mandrel. The magnitude of the cutter movement must be suitably proportioned so that the cutter rocks through an angle of 90 deg. Photograph No. 1 shows the cutter assembled on a Myford ML7 lathe.



Photograph No. 1. Blade cutter operating mechanism

A piece of $\frac{3}{16}$-in. mild-steel plate was now mounted in the toolpost, packed up so that its centre was exactly at centre height. The lathe was put in the lowest direct gear, and started, the saddle now being traversed towards the headstock to bring the job up to the cutter. If a steady pressure is kept up, a cut $\frac{1}{4}$ in. deep will be formed in two or three minutes. Several cuts were made, but I thought it made rather hard work of it, so I tried duralumin, and had much better results, so much so that I decided to make the wheel from dural. Now at this point I can imagine the red-hot flash steam chaps, smiling cynically, but to reassure them I will digress a little. When high pressure, high temperature steam is expanded through a correctly shaped nozzle, the pressure and heat it contains is converted into velocity. If everything was 100 per cent. efficient the steam could be reduced to atmospheric pressure and temperature at the nozzle exit; however, this ideal state cannot be reached. The steam comes out hot, how hot I do not know, but certainly not a great deal hotter than 212 deg. F. I have frequently run with the entry pipe to the nozzle, red-hot, for periods up to 20 min. without the wheel showing any signs of overheating, the first signs of which would probably be a burst wheel. I had a piece of $\frac{3}{16}$-in. dural plate that had once done duty as motor-cycle engine plates, so I turned up a disc $3\frac{1}{8}$ in. diameter with a $\frac{1}{2}$ in. hole reamed in the middle. I made no attempt to produce a correct De Laval section, because at this period I did not know how it was going to perform, and I was not going to do unnecessary work. I pressed this disc on to a mandrel to-

gether with a 75-tooth lathe change wheel and mounted it between centres. A thread-cutting tool was mounted sideways in the toolpost and used as a detent for locking the change wheel. A scribing block set at centre height was stood on the back of the cross-slide and short lines were scribed on the disc, thus dividing it up into 75 sections.

The blank was now mounted on the toolpost bolt with a suitable well-fitting bush and packed up to exact centre height. To cut the blades, the drill is as follows: Back up the top-slide and traverse the saddle till it buts against the rocking arm mount. Now traverse the cross-slide across till the axis of the lathe passes through the diameter of the blank, lock the cross-slide. Advance the top-slide till the cutter touches the blank, back up the saddle and with the micrometer dial on the top-slide, put on the depth of blade. Line up the edge of the cutter with a scribe line, start the lathe in lowest direct gear, and wind in the saddle till it stops. Back up, index the disc round and repeat till all blades are cut. Photograph No. 2 shows the blank half cut.

Mechanical Details

A design for the finished turbine had been drawn up when the dimensions of the wheel had been decided on, so I commenced by making the turbine shaft from nickel-steel; i.e., old motor car axle shafts. This is beautiful steel and quite easy to work. Dimensions are given in Fig. 3.

The shaft was turned between centres and left about half an inch longer than designed to allow for any snags arising. The wheel was now mounted on its shaft, and the nut done up finger tight; incidentally, that is as tight as it has ever been. A light cut was now taken on the sides and rim of the wheel, to ensure absolute truth. The assembly was then checked for static balance and found to be satisfactory.

I have, as the general arrangement in Fig. 4 shows, used ball-races for the turbine shaft. I anticipated no trouble from these at any r.p.m. up to 100,000, and have had none, the races being in as good condition now as when fitted. I decided to make the wheel shaft as stiff as possible because a flexible shaft would allow the wheel to precess all over the place when the boat hits waves, and that would be disastrous. The contruction of the wheel-case and reduction gear was then begun. I made rough castings from old pistons and gearbox casings, one of these came out with pin-holes in, but as I was impatient to see the wheels go round, I pressed on. The reduction gear ratio is 3.5 : 1, this being the ratio of a pair of nice little steel gears given to me by a friend. The turbine and reduction gear was now ready to run, apart from the nozzle. I calculated that I should want a throat diameter of approximately 0.040 in., so I made one to the dimensions given in Fig. 5, using "L.B.S.C.'s" injector reamers to form the convergent and divergent parts.

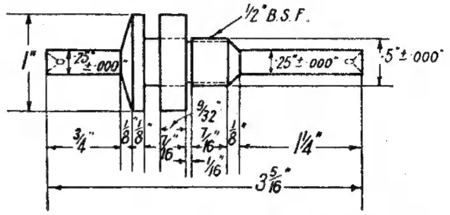
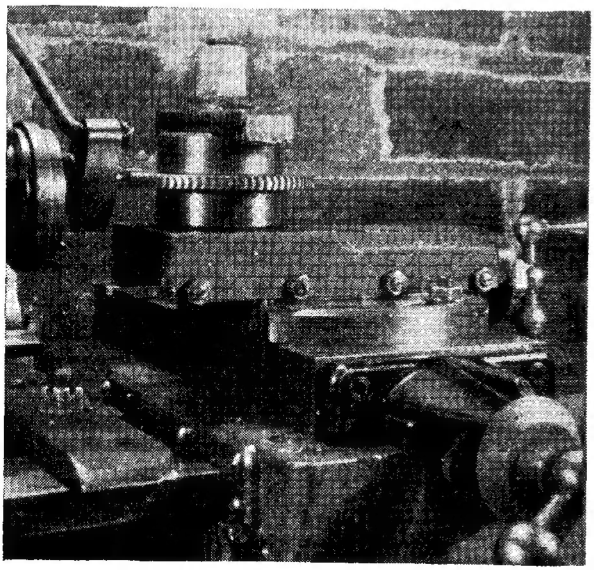


Fig. 3 Dimensions of turbine shaft

Performance

The turbine was first connected to an old Stuart Turner boiler for a No. 10 engine, this being fired by a Primus stove and two blowlamps; talk about forcing! A few minutes of this treatment and the wheel began to revolve, giving a most satisfying hum. I put a Starrett counter-type tachometer on the output shaft and found the wheel was doing 27,000 r.p.m.; I was disappointed, as it was running light. A knowledgeable friend pointed out that my nozzle was designed for 200 lb. pressure, whereas all I could muster with the aforementioned treatment, was 30 lb. gauge. I, therefore, made a nozzle with very little expansion after the throat.

I steamed up again and was rewarded with a most awe-inspiring scream which went right through the audible range and passed away into silence, broken by the roar of the blowlamps. This, I thought, was action, the turbine was really moving and nothing had come apart. I put the tachometer on the output shaft again, and found the wheel was doing 52,000 r.p.m. I felt


Photograph No. 2 Method of holding wheel blank

more satisfied with this, but it was, of course, still running light and I still had not reached my target r.p.m.

I made a tentative attempt at stressing the wheel, but there were so many factors I did not know, that the final answer was unreliable. Perhaps some reader with some experience in small high-speed components could give the matter some thought, that is, with the limited data available. However, I arrived at a figure of 80,000 r.p.m. as the limit, and I have never allowed the wheel to substantially exceed 60,000 r.p.m. Even after careful calculations on such a matter, the acid test has still to be applied, and if it bursts, well you make another.

(To be continued)

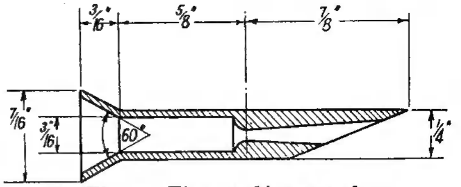


Fig. 5 First turbine nozzle

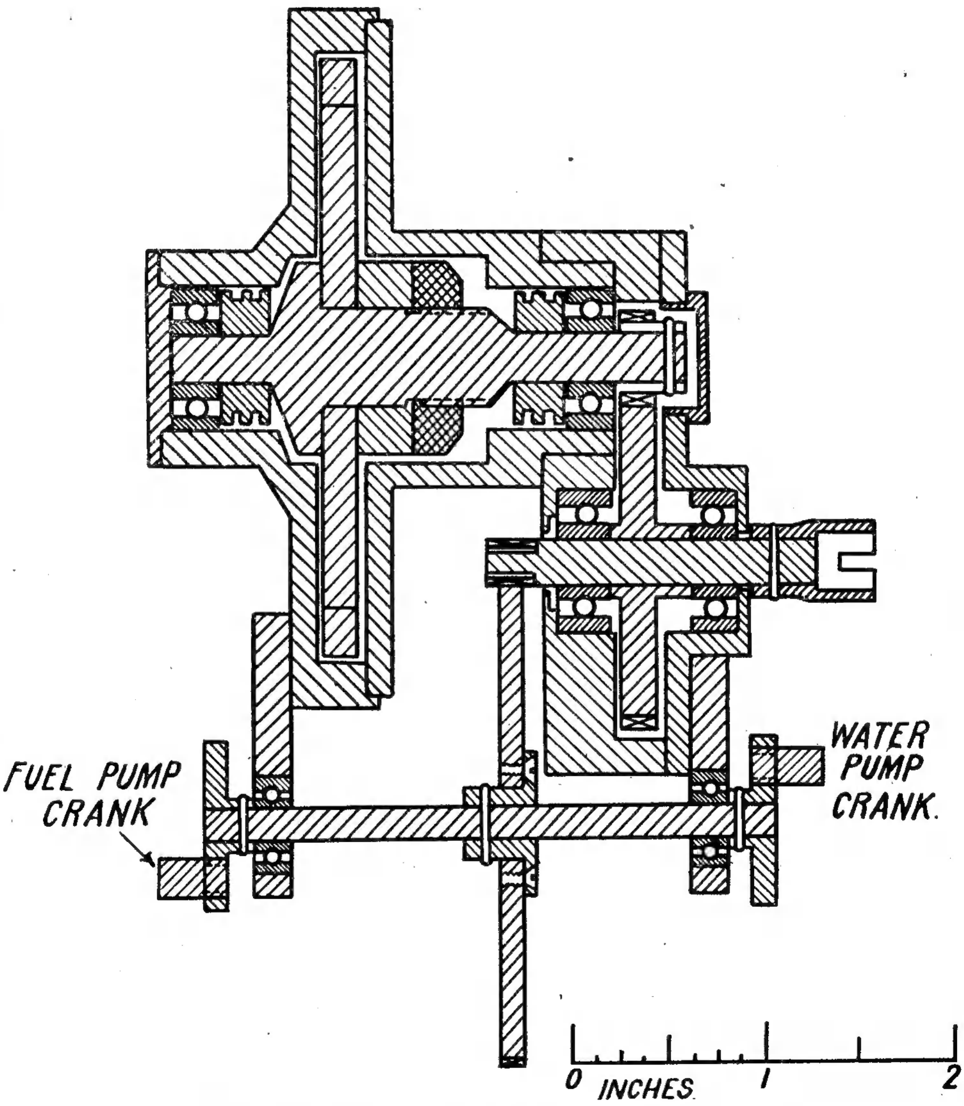


Fig. 4 General arrangement of turbine and reduction gears

MINIATURE GRAND PRIX RACING

by G. W. Arthur-Brand

Teamwork. Mr. Baigent junior refuels, while Mr. Walshaw stands by with the electric starter. Note the convenience of the elevated level

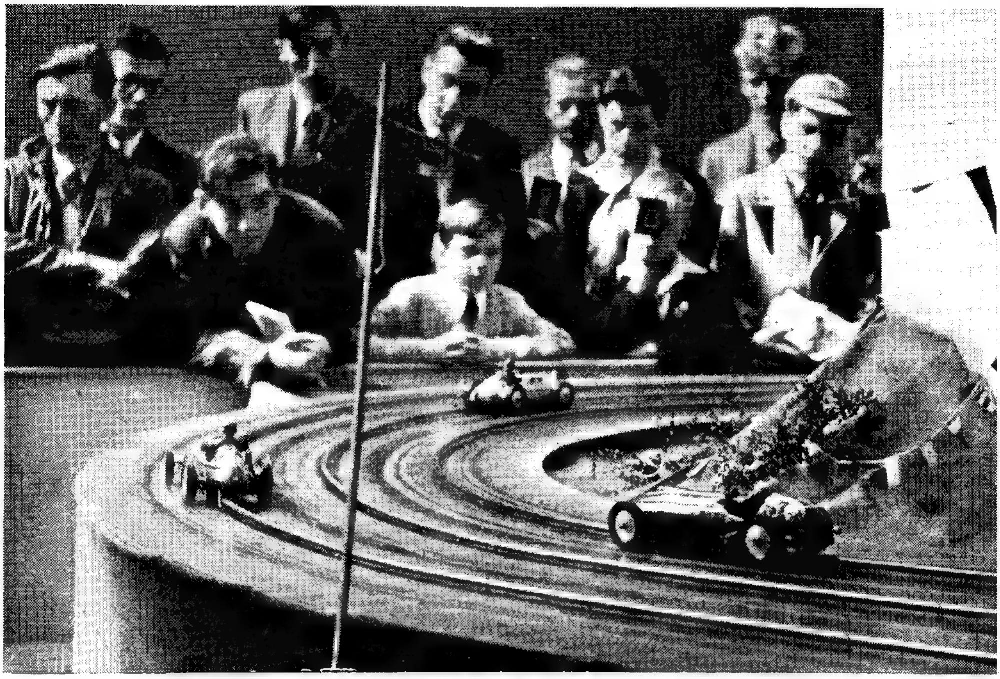
THOSE of you who heard Raymond Baxter's splendid broadcast commentary on miniature Grand Prix racing at THE MODEL ENGINEER Exhibition will undoubtedly reaslise that there is quite a considerable spectacle in this new era of model car development.

Visitors who read this article will recall the dense crowds of excited enthusiasts who packed every square inch of available space around the circuit, and some of you may have even been present when the barrier collapsed beneath the weight of the pressing mob.

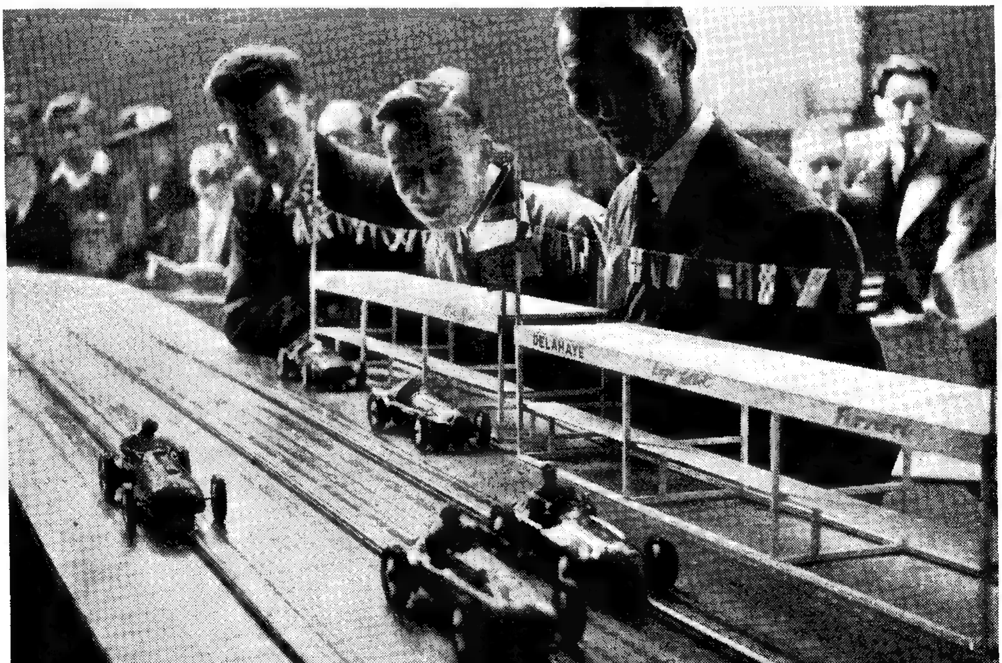
Yes, miniature Grand Prix has come to stay, and hardly a day passes without someone remarking on its splendid success as a leading attraction. The question now appears to be, how can *we* build a track, and what are the rules of the game ?

Thanks to the foresight and initiative of Mr. Henri C. Baigent, the track is now standardised and is as perfect as it can be. The cars, too, are marvels of precision and really do look like the prototypes they are intended to portray. The cubic capacities of the engines have been laid down and approved by the experts, but one

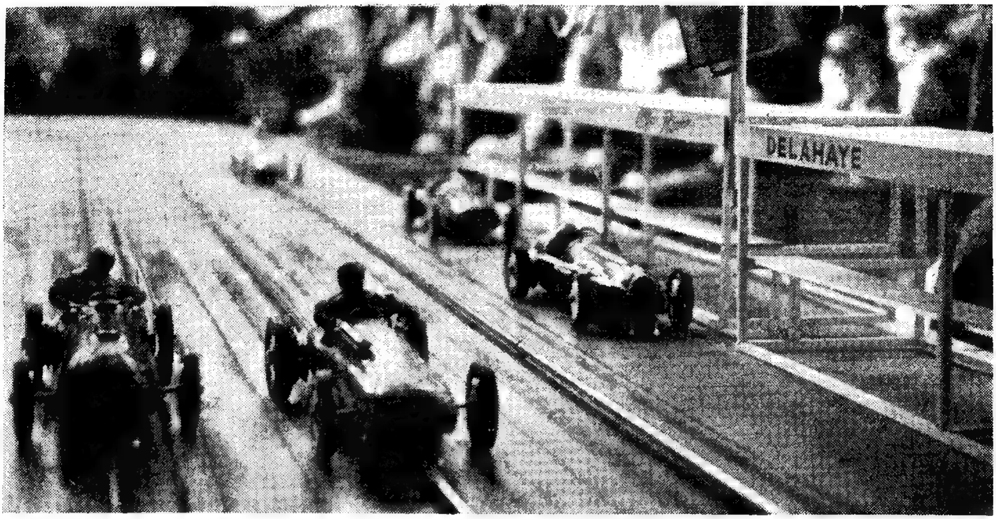
Round the bend at the top of the hill on the first lap, the Maserati takes the lead from the Talbot (centre) and Ferarri



Some laps later, the Talbot has changed places with the Maserati and streaks off in the lead round Pillar Bend!



Messrs. F. G. Buck, Baigent Jnr. and the writer spectate, as the Maserati creeps up once more on the Talbot. Note the Alfa Romeo and B.R.M. in front of their respective pits



By the last lap the Mas. has become somewhat exhausted, and it is the Ferarri which moves up to challenge the Talbot, winner by a wheel's length !

question still remains unsettled: geared or direct drive?

This and many other queries we will deal with one by one as we come to them; in the meantime, I must go back a few months to the site upon which the germ of the idea for a track at the "M.E." Exhibition was born.

It was by special invitation that I visited, on May 20th this year, the new circuit built by the Meteor M.C.C. members at Stoke-on-Trent. The obvious enthusiasm of the members who were laying down the track when I arrived (it is dismantled and stowed away in a corner of a small room between meetings) was catching, and I was soon lending a helping hand. At last everything was hooked up and it was easy to see, from the interesting layout of the circuit, that the possibilities were almost without limit.

Soon the little 1.5 c.c. motors were humming, and the cars were brought to the starting line. At the drop of the starting flag they were off in a bunch and hurtled into the first bend, wheel to wheel. On into the first straight and the sleek red Maserati leapt into the lead. Gradually, the field strung out and for several laps the Maserati held its position out in front; then in true Grand Prix fashion, the demon luck crept in and the Maserati's engine faltered. Like a flash the Ferarri shot by, closely followed by the Lago Talbot and B.R.M. On the following lap the Maserati made a rapid pit-stop for fuel adjustment and went off again in record time. Once more round the first bend and the engine screamed up, the clutch came into action and, as if driven by some unseen demented ace, the little car went after the field, now $1\frac{1}{2}$ laps in front. This was real racing!

Soon, the Ferarri retired with a broken connecting-rod, and the Talbot took the lead, with the B.R.M. a very close second. But all the time the careering Maserati was rapidly making up for lost time. By the tenth lap, the Talbot was in trouble, its engine cutting on the bends, and the B.R.M. took the lead. The spectators were on their toes and there was considerable rapid speculation as to what might happen; no one, however, anticipated the spectacular finish.

Half way through the eleventh lap, the Maserati passed the B.R.M., and hurtled into the hairpin bend. For a split second, the motor faltered, and once more the B.R.M. took the lead; but the Maserati picked up again and shot off in pursuit.

By the end of the twelfth and final lap, the B.R.M. had won one of the most spectacular G.P. events I have ever witnessed—by approximately half a wheel's length. The Talbot finished three laps behind, its engine missing badly.

Thus was my initiation, almost before I had time to realise what was happening.

During the remainder of my stay, I tried to pick holes in the system, but without success.

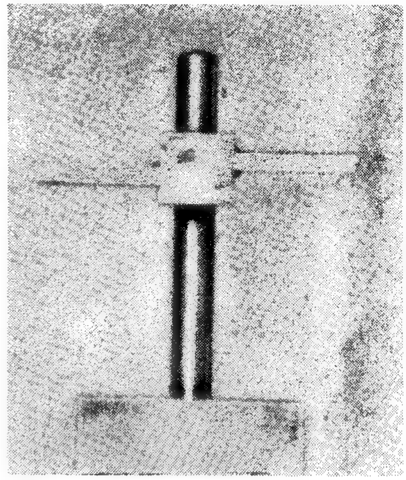
After a gruelling ten days of racing at half-hourly intervals during the "M.E." Exhibition, the little cars, powered on this occasion by 0.75 c.c. Mills engines, were still on their wheels and performing well, a fact which bears out my former opinion that Mr. Baigent had backed an all-time winner!

The Exhibition circuit followed almost identically the plan arrangement of the Stoke circuit. Reduced considerably in size, it fitted ideally into the available space on the dais and, after a lengthy discussion with Mr. Baigent, we decided that it was also the most suitable type of circuit for the incorporation of gradients. A further decision I made initially was that the track, even the lowest level, should be elevated off the floor in order to enhance the general effect, and this, too, proved to be a step in the right direction. It not only afforded a better view for the spectators, but also contributed much to the effect of realism, so essential to this form of sport. Additionally, it simplified considerably the operation of the models.

(*To be continued*)

TOOL HEIGHT-GAUGES

by L. A. Watson



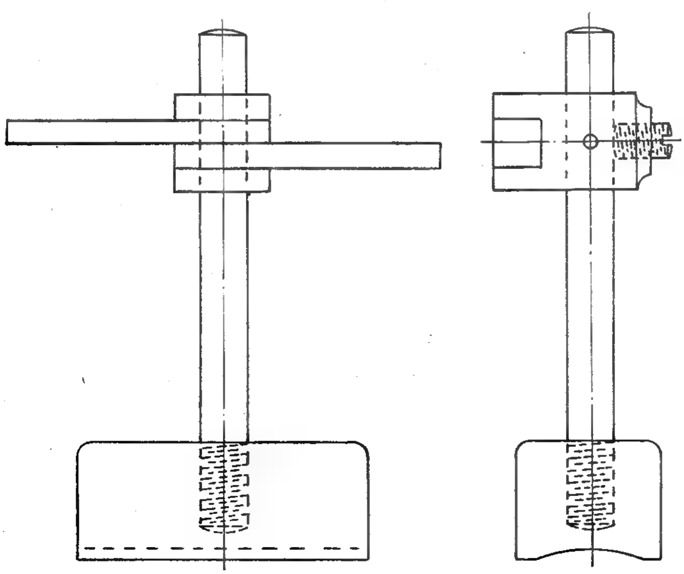
Gauge No. 1

TO obtain the fullest advantage from the adjustable tool block recently described, ■ tool height-gauge is necessary. Offering the tool point to the lathe centre point is a rough and ready approximation which has nothing to recommend it ; ■ reasonably accurate gauge is easily made and is illustrated in the accompanying drawings.

Gauge No. 1 is a simple job which can be made in ■ couple of hours. It will be seen to have two arms—one for adjusting tools used from the front of the lathe and the other for inverted tools used from the rear.

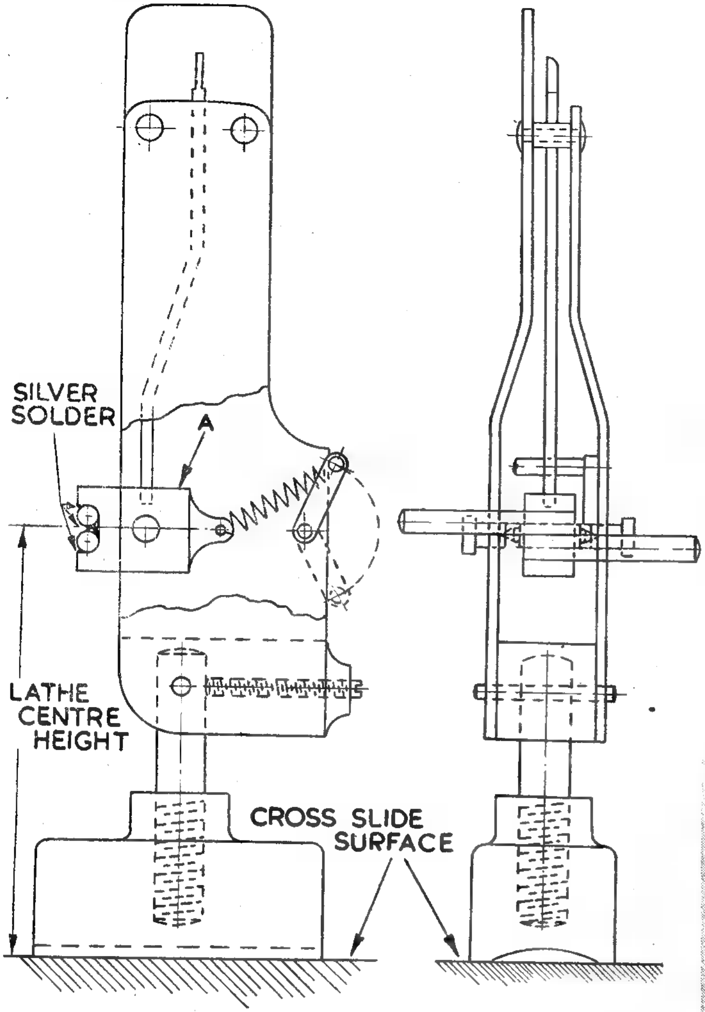
The base is ■ block of mild-steel or cast-iron about 1$\frac{1}{2}$ in. long and $\frac{3}{4}$ in. square. I recommend this rather than a circular base, because it is sometimes necessary to stand the gauge in very imited space on the cross-slide, especially if the top-slide is there as well. The underside of the base block is made slightly concave so that the production of a flat bearing surface is more readily achieved.

The column is ■ piece of $\frac{1}{4}$ in. diameter silver-steel screwed firmly into a tapped hole in the base ; the top can be slightly domed for appearance sake. The column carries a block of mild-steel about $\frac{1}{2}$ in. square, having a $\frac{1}{4}$ in. wide slot milled across the end. When I made my gauge, I had no suitable milling cutter so I used ■ metal slitting saw on an arbor between centres, and by successive cuts formed the slot in the end of a $\frac{1}{2}$ in. square bar clamped in the toolpost. The fact that the bottom of the slot was thereby made concave was of no importance so long as the sides of the slot are parallel with the sides of the bar and will take two pieces of $\frac{1}{8}$ in. thick mild-steel strip to form the arms a snug fit. Cut the piece off from the bar about $\frac{7}{8}$ in. long and drill for the column. It is essential that the axis of the hole be at right-angles to the sides of the slots so that the arms, when fitted, lie truly horizontal. Drill slightly undersize and ream or drill 7/32 in. or 13/64 in. and follow with ■ $\frac{1}{4}$-in. drill.



Front and side elevations of gauge No. ■ (full size)

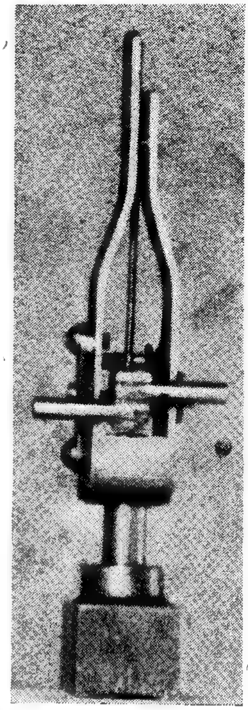
Now grip the block in the 4-jaw chuck, slotted end inwards and drill through to the column hole for the grub-screw, say, 2 B.A. or $\frac{3}{16}$ in. Whitworth tapping sizes, number size drills 25 ■ 26 as the case may be. The only purpose of the grub-screw is to lock the block on the column after final adjustment pending the insertion of a taper or parallel pin through both. While still in the chuck, finish the end of the block with ■ concave chamfer as shown.

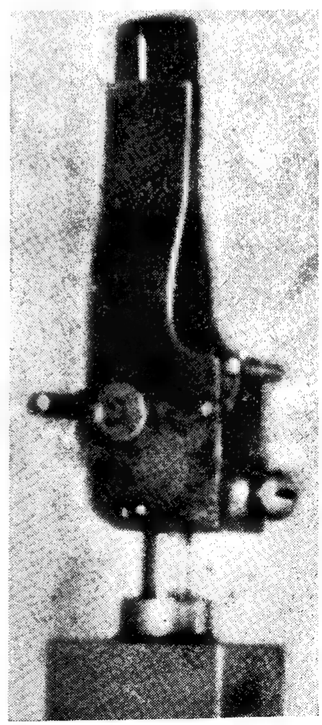


Front and side elevation of gauge No. 2 (full size)

Now cut the two [redacted] from straight mild-steel rod ¼ in. wide, ⅛ in. thick and about 1½ in. long and silver-solder in place to make a solid job.

To adjust the gauge for use, chuck a piece of ¼ in. diameter round silver-steel in the 4-jaw chuck and set it to run dead true. Take a small piece of mild-steel plate ⅛ in. thick (it is advisable to check rod and plate with the micrometer to ensure accuracy) and stand the gauge on the plate. Carefully set the block carrying the arms so that the upper [redacted] bears lightly on the top surface of the bar in the chuck. Tighten the grub-screw [redacted] to the column and check that the block has not moved in the process. Now carefully drill the transverse hole for the pin-taper if you have [redacted] suitable reamer, parallel if you have not but the parallel pin should be [redacted] force fit in its hole. A pin 3/32 in. diameter is sufficient and theoretically [redacted] 42 drill should give the necessary undersize for a force fit. This gauge will repay the

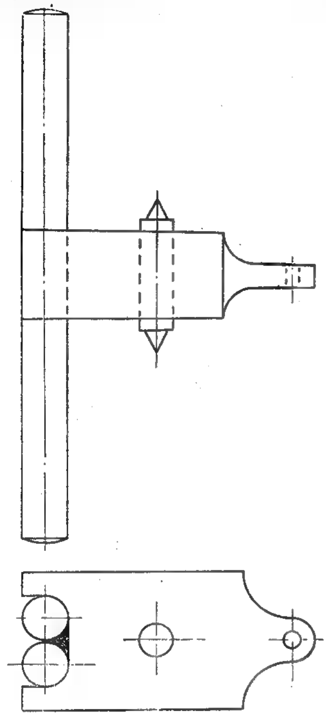




Two views of gauge No. 2

time spent on its making time and time again.

Gauge No. 2 is a more ambitious affair and may be called, I think, the gauge *par excellence.* It was designed primarily for those occasions when I wanted greater accuracy of tool setting than could be obtained with gauge No. 1—particularly when turning mating tapers. It may look complicated but is really a simple exercise in metal work, and if carefully made will give extremely accurate results. The magnification



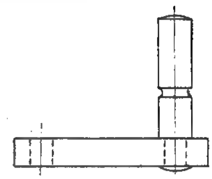
End elevation and plan of gauge arms and carrying block (twice full size)

or multiplication between bearing arm and indicator point is about 8½ : 1, so that a thou. movement of the tool will give an appreciable indication. Even if tools have springy shanks which bend slightly under stress of cut, they can be allowed to exhaust their springiness by being traversed a few times along the work without any additional feed being put on.

The base and column are similar to gauge No. 1. The sides are cut from $\frac{1}{16}$-in. mild-steel plate (brass would do) and are drilled together for pivot screws and fixing screws or rivets prior to bending to shape. Use one of them as a template to drill through the base block so that the pivot screw holes will register when the plates are assembled. Note that when drilling the holes that only one is required for the spring carrier arm. Do not, of course, drill the column for taper pin until the gauge is finally adjusted. The pivot screws I used were obtained from an old clock balance.

The block which carries the arms is about ⅜ in. wide, ½ in. deep and ¾ in. long carrying the usual ¼ in. slot for the ⅛ in. diameter round silver-steel arms. The slot can be cut or milled as described for gauge No. 1 and the arms are silver-soldered as before. The spindle is ⅛-in. or 5/32-in. silver-steel about ½ in. long and the pivots are formed with a parting tool set at an appropriate angle, about 30 deg. to the axis. This piece does not require to be hardened, as wear is negligible. It should, however, be a force fit in

Plan of spring carrier arm



the block. The indicator arm is a piece of $\frac{1}{16}$ in. diameter steel rod silver-soldered into a hole in the block and having the other end flattened for about $\frac{3}{16}$ in. long. The offset shown is necessary in order to bring the pointer central, because the pivots are not on the vertical centre-line. Ties or supports for the upper ends of the plates are formed by pieces of tube through which rivets are passed, and they also serve as stops for the pointer.

The spring carrier arm is straightforward, but do not forget the little groove which keeps the spring central. The arm is moved upward as shown in the drawing for tools used normal way up and moved downwards for inverted tools. The position shown is that which the moving block would take up when the tool is correctly adjusted. Make a zero line on the inside of the longer plate and, finally, adjust as for gauge No. 1, inserting a pin to make all secure. I now use this gauge almost exclusively, as it is more convenient to have visual indication when the tool is at correct height.

Model Racing Cars

A wet, dreary morning blossomed into a magnificent, sunny afternoon for the Sutton, Russell and Jaguar Trophies at the Eaton Bray circuit on a recent Sunday.

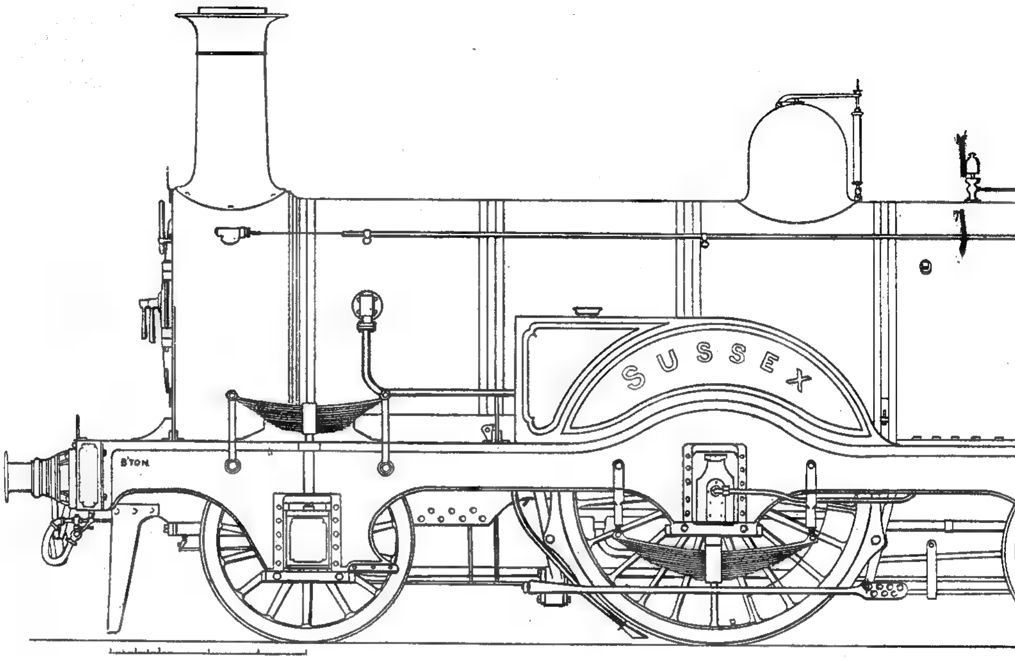
Mr. C. W. Field was once more lucky in winning the Sutton Trophy, Mr. A. F. Weaver being a close runner-up with his well-known E.R.A. It might be worth noting that the deciding factor proved to be the power department of the Field-wagon which is an o.h.v. unit of Mr. Field's own design and construction.

The Russell Trophy went to Mr. A. F. Weaver (E.R.A.) who turned in two runs at 53.41 and 54.15 m.p.h. with an aggregate of 97 points out of a possible hundred for scale, etc. Mr. Gawley's E.R.A. was runner-up.

Congratulations to Mr. Alec Snelling on winning the Jaguar Trophy with two very fine runs of 126.58 m.p.h. and 121.95 m.p.h. For this handicap event, open to cars from 1.5 c.c. to 10 c.c., 140 per cent. is allowed to 1.5 c.c. units, 53 per cent. to 2.5 c.c., and $33^1/_3$ per cent. to 5 c.c., these percentages being based on the existing records.

LOCOMOTIVES WORTH MODE

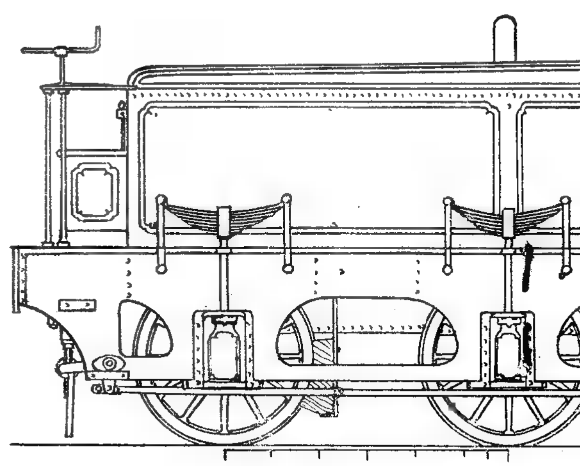
No. 35—London, Brighton & Sou



No. 203 *fitted with Joy's oil valve-gear. Note the absence of the weightbar shaft and s*

THE illustration, published in THE MODEL ENGINEER (April 19th, 1951), of Gooch's magnificent *Lord of the Isles* as shown in the Great Exhibition of 1851, recalls the days when the single-wheeler type of locomotive was greatly in favour on all our British railways. Many of these engines were employed on mixed-traffic work, their small driving wheels ranging from five to six feet in diameter. The express locomotives had, naturally, much larger wheels, as witness the fine Sturrock G.N.R. seven-footers, the L.N.W.R. *Problems* with their 7 ft. 6 in. drivers, the Daniel Gooch eight-footers, and even those of the Bristol and Exeter Ry. that sported a nine-foot driving wheel—regular giants!

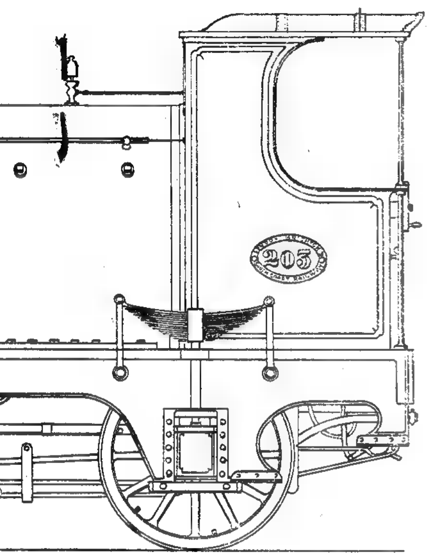
But on one railway, the famous old L.B. & S.C., a more moderate policy was pursued. As far back as 1847, Messrs. Sharp of Manchester delivered some excellent single-wheeled engines, whose driving wheels were to set a new standard of 6 ft. 6 in. When J. C. Craven designed his first express locomotives in 1863, they too, had the 6 ft. 6 in. wheel. It would seem that he believed that such an engine possessed both a high tractive effort, and great freedom in running. William Stroudley upheld this theory likewise,



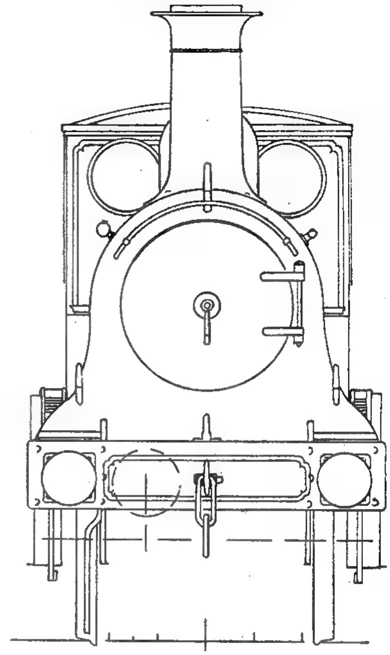
The elegant Craven tender, built for "Sussex," hac
single hand-sanding pipe. The exhaust dome anc

ODELLING by F. C. Hambleton

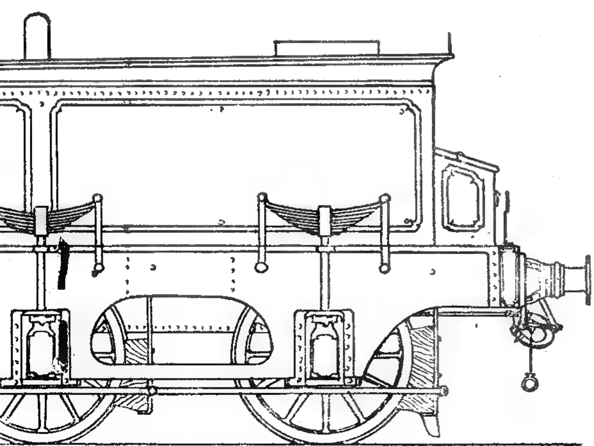
& South Coast Railway No. 203



shaft and suspension links



Front elevations are nearly always pleasing and particularly this one of "Sussex"!

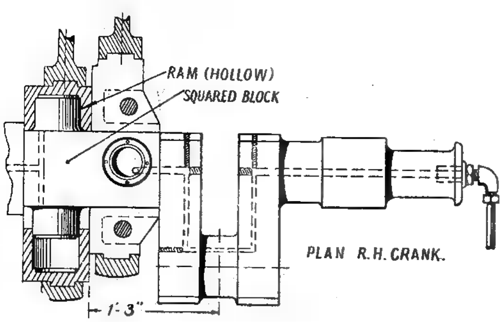


ussex," had exhaust-steam, feedwater heater, and a
ust dome and tank top were painted red lead

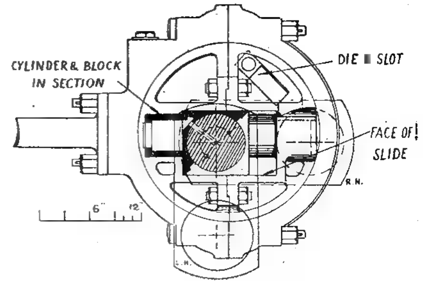
and in 1880 chose for his celebrated *Stephenson* class a 6 ft. 6 in. driving wheel. This was in marked contrast to the practice of the day. Indeed, it is probably true to say that the L.B. & S.C.R. was the only line that persistently favoured such a moderately-sized diameter of wheel.

The very first Brighton engine that Stroudly was concerned with was the Craven 6 ft. 6 in. single-wheeler No. 203. He reboilered her, named her *Sussex*, and started her on her adventurous career on April 10th, 1871. This rebuilt warrior was an interesting example of the speed at which Stroudley got into his stride on assuming control at Brighton works, for at one stroke she exhibited most of the characteristic features, which for the next twenty years or so, were to endear the Stroudley engines to all who loved the Brighton line.

A handsome yellow engine with 17 by 23—yes, 23 in. cylinders, *Sussex* became well known as a speedy and powerful locomotive. Twenty years of service made her a very familiar figure, and then, one day in 1892, the enthusiasts rubbed their eyes. They gazed at old *Sussex* carrying mysterious polished pipes which led from the



The drilled holes in the crank were suitably end-plugged. The leather packing ring can also be seen



The die on one eccentric engaging with the slot on the other ensured equal shifting movements of both

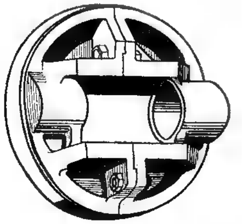
centres of her shining driving axleboxes, back along the outside frames towards the cab. The reversing lever had been replaced by a wheel, and all the Stephenson link motion, together with the weighbar shaft and its brackets and bearings had vanished. A glance below the boiler barrel revealed the fact that *Sussex* only owned two eccentrics, each one coupled direct to its valve spindle! What could all these strange things be? The answer was that No. 203 had been fitted with a remarkably clever "oil valve-gear"—the latest invention of David Joy of "radial valve-gear" fame. We have all heard of the old "loose eccentric," associated particularly with the earlier paddle-steamer engines, and at some time or another every engineer has devoutly hoped that the eccentrics of his Stephenson valve-gear would remain "fast" on their shaft, but here was a gear employing what might well be termed a "fast loose eccentric"!

Let me hasten to explain such a contradiction in terms. The essentials of the new gear were a squared steel block firmly attached to the crank-axle between the cranks themselves, and the eccentrics, the halves of which had been bolted together around this square. The eccentrics could slide (not sideways, but in a vertical plane) about the square, so varying their throw (thus providing for variable cut-off) or by sliding to their full extent could reverse the engine. To control this sliding they could be locked in any desired position by a dashpot system, familiar to us today as a feature of steam reversing gears. The dashpot cylinders were integral parts of the eccentrics, the rams fitting into them being cast on the square block bolted to the crankshaft. The locking oil passed from the reversing cylinder in the cab through fine pipes to holes drilled along the crankaxle, crank-pins and webs. The piston of the reversing cylinder in the cab could be actuated either by handwheel or by an auxiliary air pressure cylinder, as had been devised by Stroudley for his engines. At the trials held between Brigthon and Worthing, it was found that the steam distribution was almost perfect, due, in large measure, to the coupling of the eccentric-rod direct to the valve-spindle.

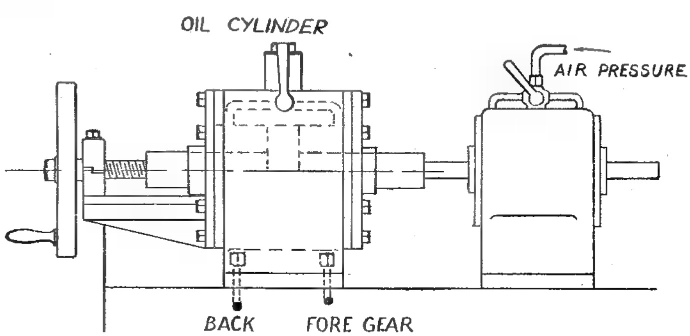
The engine could be notched up with minute accuracy. Furthermore, on one of the first runs an eccentric piston gland-leather gave way due to faulty fitting. The eccentric merely moved out into full forward gear, as was anticipated in such an event, and the driver brought his train safely to its destination. Undue oil leakage would have produced the same result, although very little leakage was experienced. Another time air was purposely introduced into the oil stream but no jumping of the eccentrics took place.

No. 203 served her company well; built in 1864, she was not scrapped until January, 1899.

Are you thinking she would make a fascinating model with that oil valve-gear of hers? Of course she would, and a handsome one into the bargain!

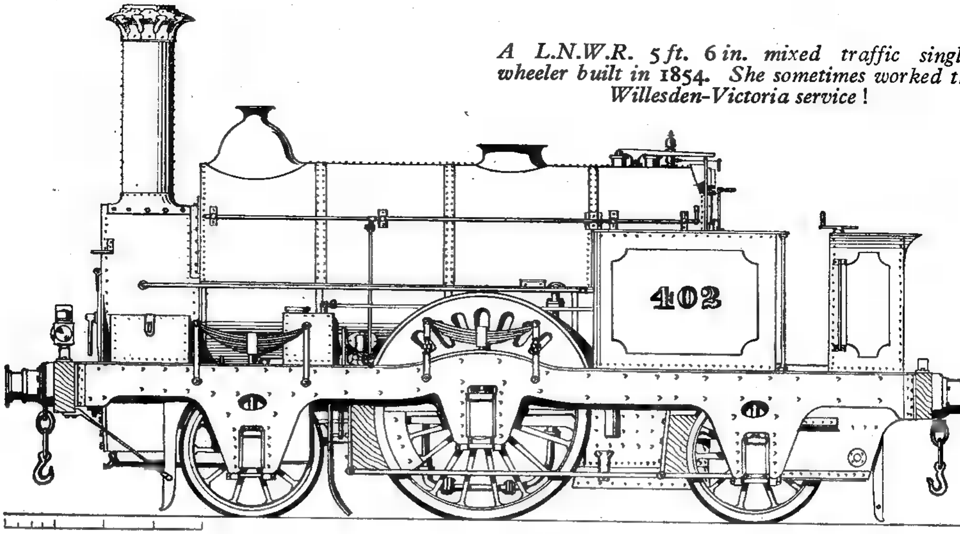


The eccentrics were cast in halves, each half complete with dash-pot cylinder and slidebars



Combined hand-screw and air reversing gear

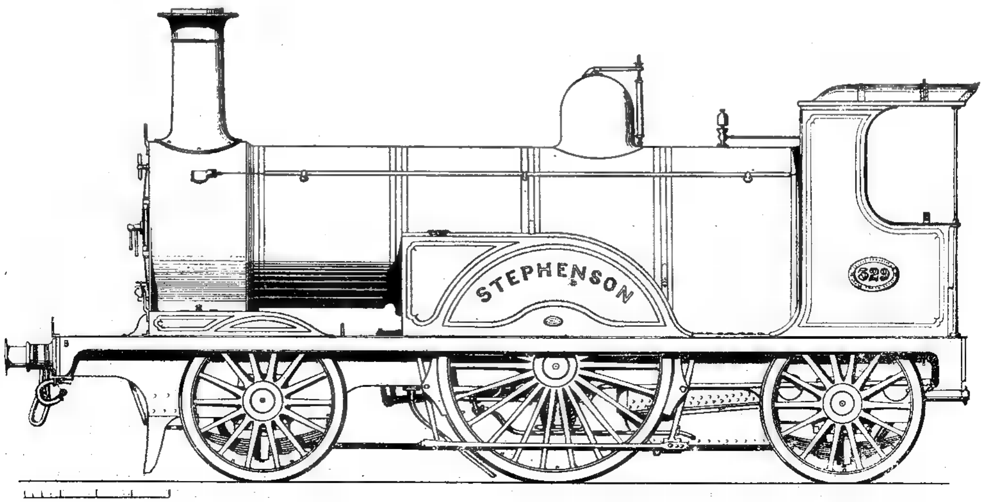
A L.N.W.R. 5 ft. 6 in. mixed traffic single-wheeler built in 1854. She sometimes worked the Willesden-Victoria service!



She was painted a medium mustard yellow, with splashers and cab sides edged with dark olive green. The black bands next this olive green had a fine white line on the inner sides and a fine red line separating olive green from black. Frames deep claret, edged with black, and a fine yellow line on the outer edge of frame, and a red line on inner side of the black. Cab roof white, guard-irons and sand-pipes red, yellow spokes and polished brass axleboxes (driving). Safety-valve levers polished steel, and brass casings to the spring of the valve. Front and rear axleboxes yellow, with olive border and red, black and white lines.

Useful Dimensions

Cylinders, 17 by 23 in.
Wheels, leading, 4 ft. 3 in.
Wheels driving, 6 ft. 6 in.
,, trailing, 4 ft. 0 in.
Wheelbase, 8 ft. 4 in.
,, trailing, 8 ft. 0 in.
Leading overhand, 4 ft. 2½ in.
Rear overhang, 4 ft. 4 in.
Boiler, diameter, 4 ft. 3 in.
,, length, 11 ft. 0 in.
Centre from rails, 7 ft. 0 in.
Firebox, length, 6 ft. 2$\frac{3}{16}$ in.
,, depth below C.L., 4 ft. 5 in.
Total heating surface, 1,288 sq. ft.
Weight in working order, 36 tons 6 cwt.
Diameter of boiler lagging, 4 ft. 6 in.
Height of chimney, 3 ft. 10 in.
Diameter inside of chimney at top, 1 ft. 4 in.
,, ,, ,, ,, at bottom, 1 ft. 5 in.
Footplate above rails, 4 ft. 2 in.



William Stroudley also believed in the 6 ft. 6 in. single driving wheel

A USEFUL DESIGN OF HAMMER

by W. M. Halliday

USUALLY most practical mechanics and amateur engineers will prefer to design and fashion their own hand tools to be employed for cutting or measuring operations.

By this means they will be enabled to incorporate easily some specially useful or distinctive feature, which they have found from practical experience will facilitate the use of such a tool, or give better working results.

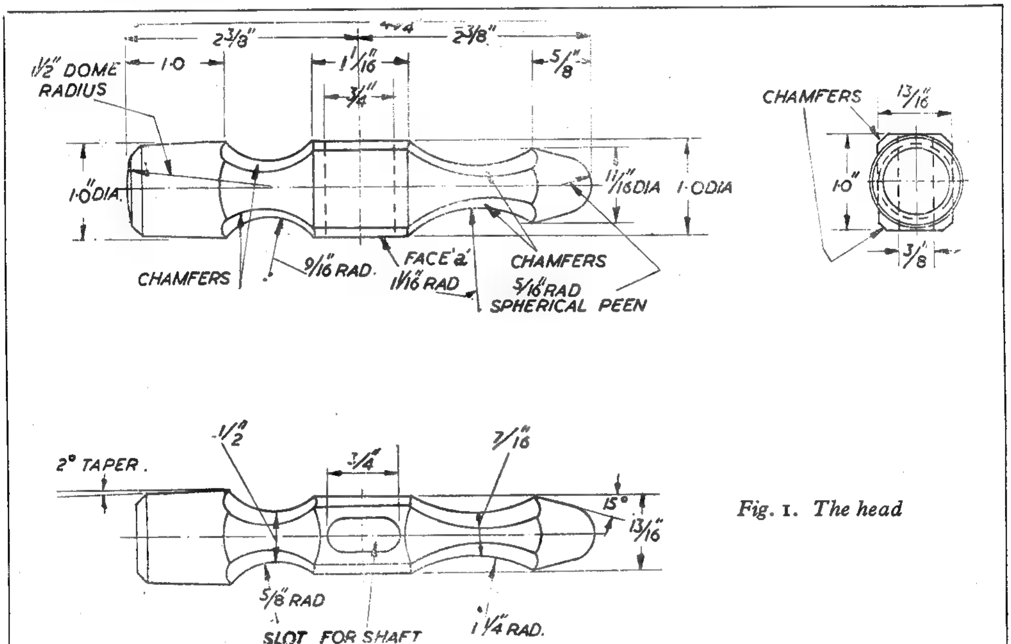


Fig. 1. The head

Curiously enough, very few mechanics give much attention to the ordinary hammer employed so extensively in all engineering and tool-making activities. Generally, they will be quite content to use the ordinary commercial form of hammers.

These latter, however, often leave much to be desired, both as regards their utility and appearance. Especially will drawbacks be present in respect of the kind of shaft employed with such standard tools.

Very often the shaft will be far too long, or unduly short in relation to the weight of the head.

The shape of the shaft may be very unsatisfactory, usually by being formed too thick and having great rigidity and stiffness.

The shaft may have an improper shape to ensure a comfortable hand grip, with the result that the user's hand and wrist will speedily tire after using such a tool for only a very short time.

Moreover, ordinary hammers are rarely correctly balanced, which again will make for tedious handling.

The hammer head may also be found to have an unsatisfactory shape, especially on the peen ends, for many of the delicate hammering or riveting operations which the toolmaker, or model engineer, has to conduct.

A good hammer should be of the correct weight, fitted with a shaft of the requisite length and thickness to impart good balance. There should be a certain degree of resilience in the shaft, so that shocks reacting from the head when striking a work-piece will not be transmitted back to the user's hand.

The shaft should possess a smooth grip having a shape conforming to the normal gripping action exerted by an operator. This shape should preferably be of such a form as will minimise slipping tendencies as far as practicable.

In short, the hammer, to give best results and greatest satisfaction to the user, should have a distinctive "feel" of its own, a characteristic which will be readily understood by most engineering craftsmen.

The improved design and construction of an effective toolmaker's hammer illustrated and described in this article, has been developed and used by the writer with considerable success.

It has been found eminently more suitable and convenient to use than any ordinary kind

of conventional hammer, and is specifically designed to meet the essential requirements just mentioned.

The hammer head and shaft were made up along the following lines, as clearly depicted in diagrams Figs. 1 and 2. These drawings denote the respective shapes employed for each component, and suitable dimensions for a medium-sized hammer having a total weight of about $\frac{3}{4}$ lb.

These dimensions may, of course, be varied to suit a larger or smaller hammer as desired,

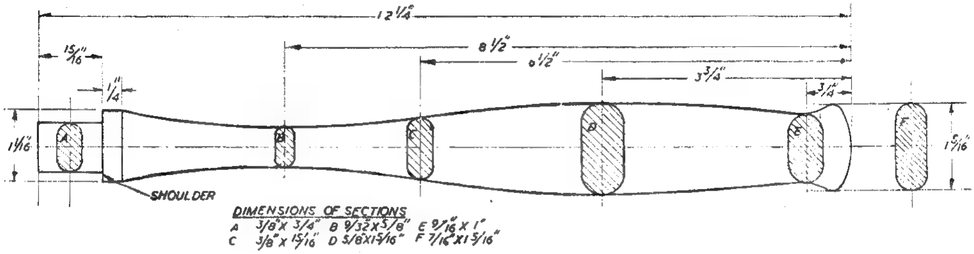


Fig. 2. The shaft

but any increase adopted should be effected proportionately throughout the head and shaft to maintain proper balance and pleasing appearance in the finished article.

The Head

This member is produced chiefly by turning in the lathe, using standard $1\frac{1}{8}$ in. diameter bar stock, in cast-steel, of course.

This is machined to the various diameter and length proportions shown (Fig. 1) and is provided with a ball end peen for normal riveting work.

If desired, a cross-flat peen, or a duck-bill ditto may be employed to meet working requirements.

The largest diameter end is made slightly taper, using an angle of about 2-4 deg. as shown. This portion terminates in a very slightly domed end-face for ordinary straight hammering, and the edge is well chamfered at about 45 deg. to minimise mushrooming effects, and to avoid striking glancing blows on the work.

The opposite end is turned to a much smaller diameter and turned semi-spherical in shape at the extreme end to provide the ball peen.

The centre portion of the head surrounding the socket hole into which the shaft will be fitted is machined with substantial flats on all four sides, making the thickness dimension appreciably less than the maximum diameter of the head.

The portions between this socket hole surround and the two peens are filed with a series of flats, each being made slightly concave to the radii denoted.

Eight of these flats per portion are provided, so that these parts of the head will be amply chamfered. The purpose of this flattening is to reduce the weight of the head, to give better balance, and to enhance its finished appearance.

The socket hole is drilled and filed out to the dimensions given, preferably making the hole parallel for its full length.

After machining and completing this elliptical hole, and smoothly polishing all external surfaces, the head should be hardened and tempered in the usual manner, afterwards being brightly polished throughout.

The Shaft

Perhaps the most distinctive feature possessed by this improved form of hammer is in respect of the shaft, which, doubtless, will be understood by referring to the diagram, Fig. 2, which shows the shape and dimensions of the part.

It will be noted this shape differs very considerably from that of the usual standard type of hammer shaft, the handle portion in particular being adapted for easy and very comfortable gripping in a manner which is often completely absent with the usual type of hammer shaft.

This shaft will be found very greatly to reduce strain on the wrist and fingers, and also is free from the tendency to slip out of the closed hand during chipping, or light riveting operations, when it will be essential not to grip the handle too tightly.

The cross-sectional views super-imposed on the drawing at six different points throughout the length will clearly indicate the contouring requirements when machining the part.

The respective dimensions of these portions are given for convenience. It will be noted that the shaft is substantially elliptical in cross-sectional shape throughout its entire length, differing in size at various points, and having the maximum dimensions at the handle end.

When making the shaft, a rectangular piece of seasoned hickory was selected, this being about $12\frac{1}{2}$ in. overall length and $1\frac{1}{2}$ in. wide and about $\frac{5}{8}$ in. thick.

It was mounted in the lathe and turned over the top to reproduce the required curvature and dimensions shown.

After removal from the lathe the proper elliptical shape was quickly fashioned by spoke-shaving and sanding at all four corners, this operation consisting of merely rounding those corners to produce a complete semi-circular shape at each side after the fashion shown.

The shank portion at the left, required to fit into the socket hole in the head, is made approximately $\frac{1}{16}$ in. shorter than the length of hole, for a reason to be explained. It is also made with a slight taper, being of the smallest dimension at the extreme front end. A taper of about 2-3 deg. will be found sufficient. A large degree of taper such as is usually found with conventional shafts

(*Continued on page* 492)

Novices' Corner

Making a Boring Bar

THE small boring bar illustrated in Fig. 1 is shown mounted in ■ square holder for clamping in the lathe toolpost, but the bar, when removed from its holder, can also be gripped in ■ chuck carried on the lathe mandrel nose. Where the tool is mounted on the lathe saddle, ■ component held in the chuck can readily be bored to any required diameter with the aid of the cross-slide index, and whether the bore is formed parallel or tapered will depend on the setting of the lathe slides. If, however, the bar is mounted in the lathe chuck, and the work is attached to the lathe saddle, the diameter of the bore then machined is regulated either by adjusting the setting of the cutter in the bar or, within limits, by altering the setting of the four-jaw chuck. In any event, a bar of this kind is apt to spring and so cause inaccurate machining if mounted with too much overhang.

The other type of boring bar in common use, shown in Fig. 2, is centred at both ends so that it can be mounted between the lathe centres and driven by ■ carrier from ■ dog attached to the lathe catch plate. Clearly, if the bar is of sturdy construction, there will be little possibility of the tool springing when rigidly supported in this manner. The work-piece, ■ cylinder casting maybe, is clamped to the boring table of the lathe saddle, and the boring bar will then machine a truly parallel bore in the component; moreover, the axis of the bore will be parallel with the guides of the lathe bed.

To regulate the diameter of the bore formed, the position of the cutter-bit in the bar is adjusted

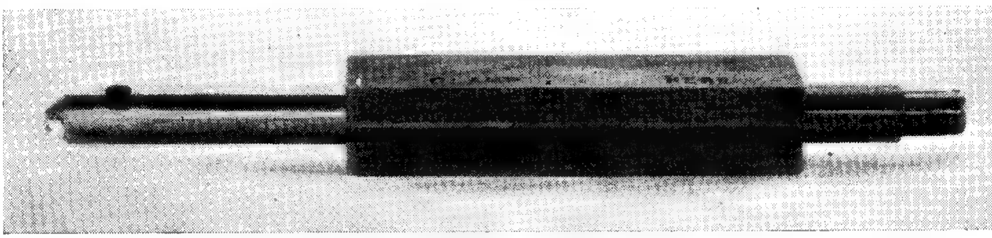


Fig. 1. A small boring bar with its holder

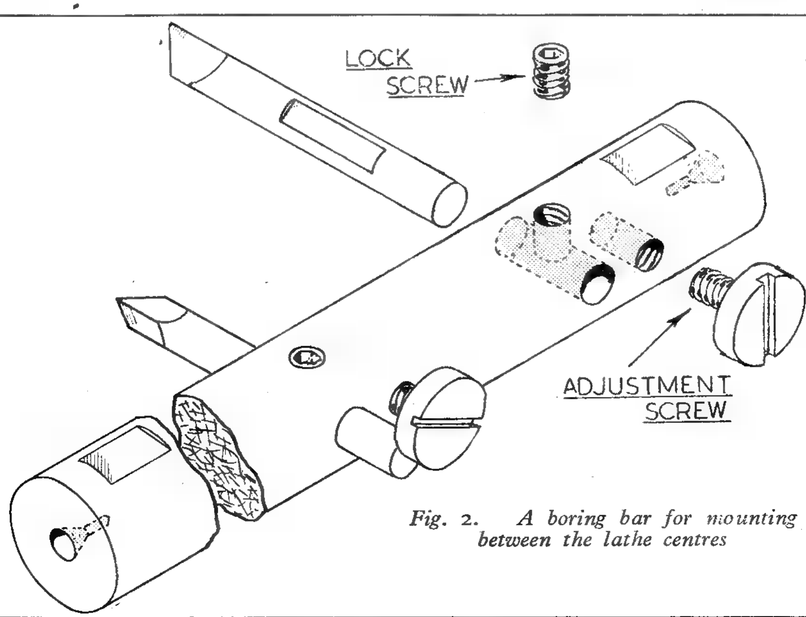


Fig. 2. A boring bar for mounting between the lathe centres

[redacted] required, and various methods of making this adjustment have been devised. If the cutter is secured with a wedge, there is always the danger that the setting will be upset [redacted] the wedge is tightened, or the tool may shift when actually cutting. These difficulties can usually be overcome by using [redacted] clamping-screw to hold the cutter, and fitting a second screw to move the cutter forward; this adjusting-screw will also serve to keep the cutter from moving back away from the work under the pressure of the cut.

As one of the great advantages of the boring bar mounted between centres is its rigidity, this must not be sacrificed by making the bar too slender. That is to say, if a lengthy bar is used, the diameter should be increased accordingly; moreover, if the bar is intended for machining a bore of small diameter, the length should be kept as short as possible in order to maintain rigidity.

The boring bar illustrated has a diameter of $\frac{3}{4}$ in. and a length of 9 in.; with these proportions, the tool has been found capable of doing quite heavy but accurate machining.

When making a slender boring bar, the weakening effect of the drill holes for mounting the cutter should be taken into account.

Making the Boring Bar

The construction of small boring bars and their holders for use in the lathe toolpost has already been dealt with in these articles, and the making of a boring bar for mounting between the lathe centres will now be described.

As already stated, [redacted] bar $\frac{3}{4}$ in. in diameter and some 9 in. in length will be found sufficiently rigid for all ordinary work, and if the size of the bar is reduced for any special purpose, these proportions are best adhered to.

After [redacted] straight length of mild-steel rod has been selected, the next step is to machine [redacted] centre at either end to engage with the lathe centres. To enable the bar centres to be machined accurately in line, the rod is gripped close to one end in the chuck, as illustrated in Fig. 3, and the other end is supported in the fixed steady clamped to the lathe bed. The overhanging end is next faced, and then deeply drilled with [redacted] centre drill. To finish the centre so as to protect it from accidental damage, the centre of the bar is recessed [redacted] shown in Fig. 4. The work can now be reversed, and the other centre machined in the same way.

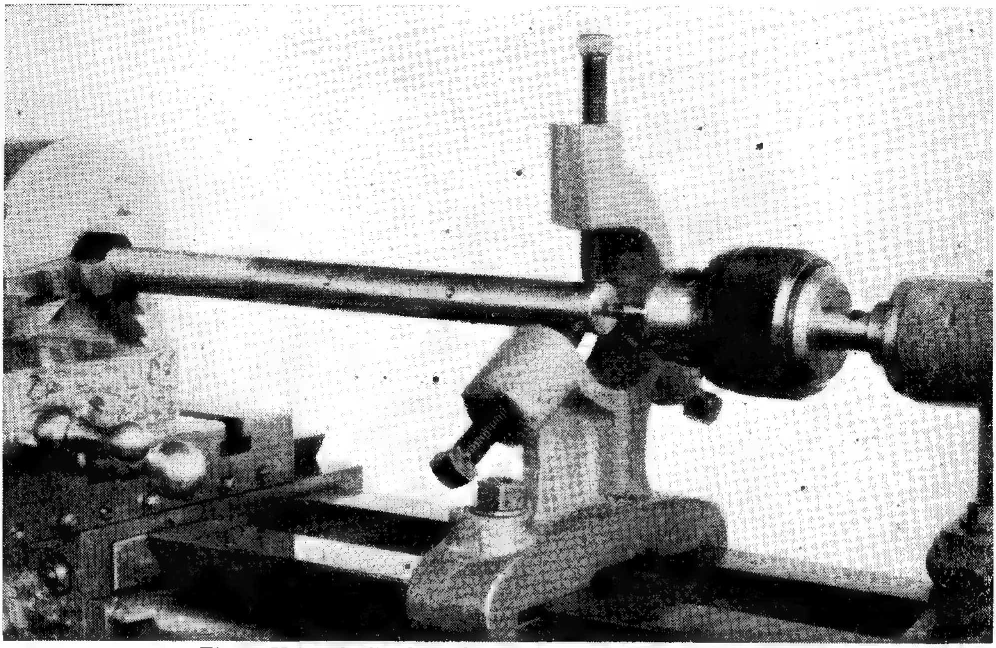


Fig. 3. Using the fixed steady when centre-drilling the ends of the bar

In addition, it is advisable to turn that portion of the bar where the cutter is to be fitted, as this will facilitate the accurate adjustment of the cutter itself when the bar is in use.

To afford [redacted] secure seating for the lathe carrier used to drive the bar, [redacted] flat, or a shallow drill-hole, should be formed on both ends of the bar, so that if required, the tool can be reversed and driven from the opposite end. Before cross-drilling the bar for the cutters and their fixing-screws, the question of whether to fit round or square tools must be decided, for high-speed steel cutter-bits of either form are obtainable from the tool-merchant. However, round silver-steel will serve well for making these tools, and, when this material is used, the cutter can easily be filed to shape before being hardened and tempered.

The round cutter shown in Fig. 5 is easily

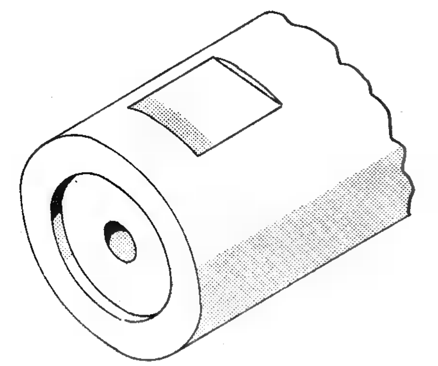


Fig. 4. Showing the recessed end of the bar and the driving flat

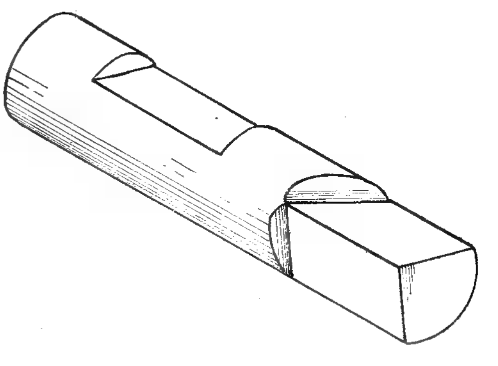


Fig. 5. A round cutter-bit for use in the boring bar

fitted, [redacted] the mounting hole in the bar can be accurately reamed to size, but a square hole for the other type of cutter is not so readily formed by filing. The tool illustrated has both side- and end-clearance, and the amount of cutting rake given will, of course, depend on whether brass, steel or cast-iron are being machined. A rake of 15 deg. to 20 deg. will be found suitable for steel, and rather less for cast-iron, but if a rake angle of about 5 deg. is exceeded, the tool may tend to dig in when machining brass.

The rake is, of course, formed on the upper surface of the tool and lies at an oblique angle with line of the tool's travel.

When marking-out the bar for the position of the cutter, it is a good plan to provide for mounting two cutters, as this arrangement will at times be found useful when machining the two end portions of [redacted] lengthy component ; moreover, an alternative position for mounting [redacted] single cutter may also be required.

The holes to receive the cutters and their fixing-screws can be accurately drilled by using the small cross-drilling jig described in a previous article.

A Useful Design of Hammer

(*Continued from page* 489)

is not satisfactory, and often leads to splitting of the shaft at that point.

Immediately behind the shank the shaft is formed with [redacted] enlarged square shoulder, whose overall dimensions are identical with those of face *a* on the underside of the head. (See Fig. 1.)

This shoulder has to be abutted closely against face *a* at the final fitting of the head to the shaft, which, after shaping, is finally given two coats of clear varnish.

Securing the Head to the Shaft

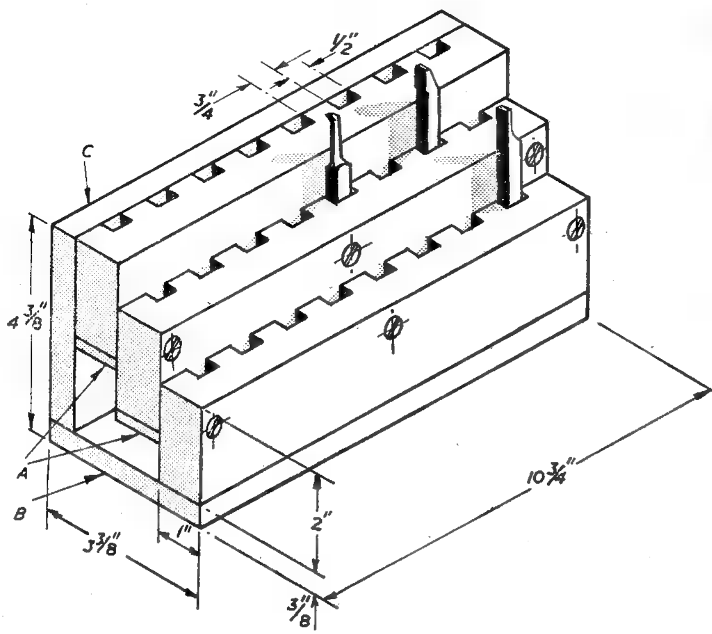
To overcome the irritating tendency of the hammer head to work loose on the shaft, another useful feature is incorporated in this design.

The shank of the shaft is carefully fitted into the elliptical socket hole in the head, until the shoulder is about $\frac{1}{16}$ in. clear of face *a*.

A small steel plate, rectangular in shape and about 3/32 in. in thickness, having its overall dimensions the same as those of face *a*, is drilled for [redacted] ordinary countersunk wood screw. This plate is situated on the face opposite to *a* and the screw passed centrally into the wooden shaft, thereby drawing the shaft completely into the head and with the shoulder closely in contact with face *a*. By reason of the slight side taper on the shank and the contact of the square shoulder, [redacted] very powerful grip will be obtained. To enable the plate and screw to exert the maximum locking pressure, the shank should not project beyond the opposite side of the head, hence the reason for making this portion $\frac{1}{16}$ in. less than the head thickness.

One advantage derived by this simple form of fixing is that the bulk of the shock and hammering pressure has not to be taken solely by the shank fitting in the head. The enlarged shoulder will take [redacted] considerable portion of such shock and loads, so preventing the head from working loose, or the shank from splitting.

If desired, instead of using [redacted] plate and screw, the shank may be split to receive the usual tapered wooden wedge, but the shoulder formation on the shaft could still be employed with great advantage.



A Simple Tool-Rack for the Lathe

by "Base Circle"

As a rule, when a lathe is first installed, the number of tools is small and storage does not present any difficulties. They are just laid on a shelf or dumped in a drawer. Later, however, when more tools become available—and it is wonderful how quickly they accumulate—it becomes necessary to provide some sort of rack for them, not only to make the selection of the appropriate weapon more easy, but to preserve the cutting edges from damage—more especially if there are any form tools among them.

Holes in Wood!

The first thought is usually to get a chunk of wood and drill rows of holes in it to take the tools. This is all right up to a point, but has certain drawbacks. First, the front row of tools hides the rear ranks and makes selection difficult, and secondly, we metal-workers don't always have available suitable wood-boring bits, with the result that the appearance of the finished block usually leaves a lot to be desired.

Tiers of Tools

The rack shown in the isometric sketch gets over both these difficulties. The tools, as will be seen, are in tiers, so that each one is clearly seen, while the construction is of the simplest. A hack-saw could be used for all the cutting if a tenon saw is not available, and the only other wood-working tool required is a chisel about ⅜ in. broad. At a pinch, a suitable flat file could be ground to a cutting edge to do duty as a chisel—and that, too, without impairing its usefulness as a file.

Construction

As will be seen, the rack is built up from three lengths of wood about 2 in. × 1 in. section. As shown, the pieces are 10¾ in. long, which allows for eight tools in each row or a total of twenty-four, which is quite a reasonable allowance. If it is desired to accommodate more tools, the rack can be made longer or there can be four rows instead of three. The slots ½ in. wide by 7/16 in. deep are suitable for ⅜ in. sq. tools. (The only reason for making them ½ in. wide in this case was that the narrowest chisel available was ½ in. wide).

The three lengths are held together by 1½-in. csk.-head wood screws, as shown. The strips *A* 1 in. wide by about ¼ in. thick are screwed to the bottom of the slotted pieces to support the tools. In the case of the front slotted piece, the base board *B* supports the tools. It will be 10¾ in. long by 3⅜ in. broad, and can be about ⅜ in. thick. This piece is screwed to the front slotted piece and to the piece *C*, which serves as a back support and also closes the back row of slots.

Suitable Woods

The three main parts in which the slots are cut should preferably be made from a hardwood of some kind, but any kind of wood could be used for the other pieces. Scraps of plywood would do very well.

A good rub down with sandwich-free sandpaper and a coat of paint or varnish should make the rack quite presentable, as well as a most useful article for any model engineer's workshop.

"L.B.S.C.'s" Beginners' Corner

How to Run "Tich"

DURING the time that the notes and instructions for building *Tich* were in progress, I received quite a spate of correspondence from beginners and inexperienced workers, asking for all kinds of information; and many of the writers expressed a wish for some hints on running the little engine when completed. As one motoring reader aptly put it, it's no good owning a Rolls-Royce if you don't know how to drive and look after it. Same applies to locomotives large and small. It takes a full-size driver many years to learn how to handle a locomotive in the most efficient way; in fact, it would not be exaggeration to say that he has never finished learning. The finest engine ever turned out from Swindon, Crewe, Doncaster or any other big works, cannot give of its best if improperly handled. Readers of these notes may follow implicitly, all the instructions I give, and with careful workmanship, produce an excellent engine, capable of doing all I claim—and a bit extra for luck; yet that same locomotive may be an abject failure on the track, simply for lack of knowledge of the proper way to fire and drive her. It has often happened in full size, that the first engine of a new class has been put into service, and the drivers and firemen who ran her, were used to running different classes of engines altogether. The methods used for the older engines did not suit the new one, and she has not performed as well as expected; yet the fault lay, not in the engine herself, but in the engine crews. The L.M.S. Pacifics were a case in point. The enginemen were only used to engines with narrow fireboxes, the wide firebox of the 4-6-2 needed firing in an entirely different manner from that for the narrow boxes, and there were plenty of steaming—or rather no-steaming—troubles until the enginemen "learned the trick," in a manner of speaking. When they did, it wasn't only the fur that began to fly!

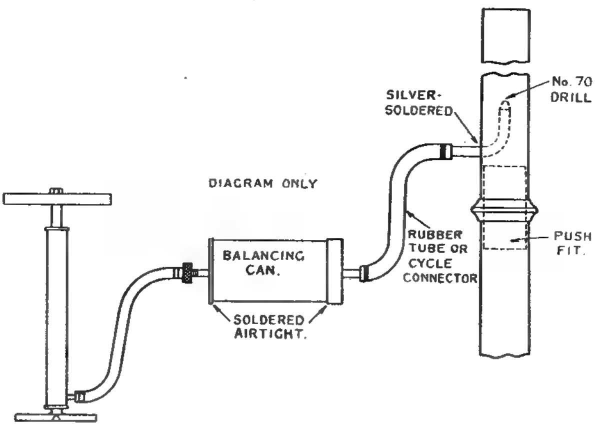
Facts About Fires

If our beginner friends will get the following few facts well and truly planted in their noddles, they won't have any difficulty in running their little engines successfully. It is barely necessary to point out, that the bigger the fire, the greater its stability. A weeny fire is quickly lit, and brought up to full incandescence, which being interpreted means bright red all over; but the drawback is, that it will die out just as quickly without certain precautions being observed. Item No. 1 is that the fire needs a certain amount of oxygen, which it gets from the air, to keep it burning at the point where it gives out the maximum of heat. If it doesn't get enough air, it burns dully, and the boiler won't make steam. If too much air is drawn through, loose particles are lifted, drawn through the tubes and blown out of the chimney, whilst holes will appear in the fire. Cold air enters through the holes, cools the inside of the firebox, and down goes the "clock" again.

If a small fire is made up too thick, the blast cannot draw sufficient air through it, and it will not only burn dully, but the bottom part of the fire will burn away first, and the ash and other residue will probably choke the air spaces between the firebars, thus kind of "piling on the agony." If the fire is too thin, the effect mentioned in the preceding paragraph will occur. If the fire is heaped in the middle of the box, the sides burn away first, and cold air is drawn in close to the plates. If the fire is thick at the back and thin at the front, or vice versa, same thing happens, as the thinnest part of the fire always goes first. In full size, the correct way to fire a narrow box, is to fire around the sides, under the door, and against the tubeplate, putting very little in the middle, so that the bulk of the fire is in contact with the firebox plates. In a little firebox, the best thing is to keep the fire even. You can't "scale" nature; and the fire acts in exactly the same way, subject to the same natural laws, in a box three inches long as it does in one three yards long. There is such a tiny distance between the middle of the fire, and the firebox plates, that the "saucer" fire would show no advantage, and probably go into holes in the middle. When a grate slopes from back to front, it is usual, in full-size practice, to put more coal on at the back, under the door and in the back corners, than at the tubeplate end, as the movement of the engine tends to shake it down. This applies equally to small size; my single-wheeler *Grosvenor* has a sloping grate exactly the same as her big sister of blessed memory had, and it performs best when fired in the same manner. On the evening of August 31st she made a nonstop run of 55 laps, just over 2½ actual miles, hauling my weight (equal to a 250-ton train) at an equivalent of 90 m.p.h., during which, I dropped two shovelfuls just inside the door. The little nuggets, about the size of small peas, shook down and levelled themselves over the sloping grate during the next couple of laps.

Making a Draught

We already know that coal requires air to make it burn; and to get the air through the firebox in sufficient quantity, we must create a draught. A pity we can't bottle up some of the confounded draughts that come in through windows, doors, and sundry other places, on a winter's night, and make use of them! Many good folk don't realise that there is no natural draught through the firebox of even a full-sized



Simple air blower

locomotive; the breeze has to be created by blast and blower. Now and again you read in the newspapers, of a driver and fireman being burnt—sometimes, alas! fatally—by what the uninitiated reporters call a "blow-back." If a driver inadvertently forgets to open the blower-valve before he shuts the regulator, flames will pour from the firehole instead of going into the tubes, and set the enginemen's clothes alight in a fraction of a second. If the engine has a short chimney, and is running chimney first, against the wind, the latter will blow down the chimney and help matters on.

The blast and blower of the tiny engine serve the same purpose, and work exactly the same, as in full size; but whereas a full-sized engine's fire will burn up slowly, of its own accord, after being lit up in the shed, the little one won't do anything of the kind. The big fire burns up on the same principle as the bonfire you may light in the garden, to burn the rubbish, or maybe to amuse the kiddies on Guy Fawkes night; the combustion is too slow to require any additional draught. This slow-burning fire will get steam up in the full-sized boiler, but very slowly; *Grosvenor's* big sister took about four hours from all cold. This is quite in order, because if a big locomotive boiler is forced, the expansion will be uneven, and tube and stay leakage will ensue. The slow combustion will not produce enough heat to maintain working steam pressure; but once the boiler has reached the temperature of boiling water all over, it may be forced to any extent within reason, without injuring it in any way. The reason why the big fire can be lit and left to burn up, is because of its bulk. There isn't enough bulk in the little fire, to follow suit. Even if the contents of the firebox (wood or charcoal) are soaked in paraffin, the latter would just burn out—incidentally, you'd need a gas mask!—and there might be a few red embers left, but they would only last a minute or so. But if a current of air is passed through the firebox, the small fire will not only keep alight, but quickly raise enough steam to work the engine's own blower, and bring the pressure to working level. Well, I hope the above explanation hasn't bored our more experienced friends; but if you had read some of the letters I have received, you would agree that it was needed by many of our fraternity who are raw recruits, and totally ignorant of the whys and wherefores.

Simple Auxiliary Blower

The simplest way of creating the necessary draught through the firebox of *Tich*, to get steam up, is by aid of an auxiliary blower. This consists of a piece of tube about 6 in. long, just large enough to be a push fit in the chimney; or a piece of the same diameter as the chimney will do. Bend a piece of 22-gauge sheet brass or copper about 1 in. wide, into a tube that will push into both the chimney and extension tube; silver-solder it into the latter and push the protruding piece into the engine's chimney when using it. A blower jet is fitted in the extension tube about 1 in. from the bottom. Close up the end of a piece of 1/8-in. or 5/32-in. tube, by hitting it all around with a hammer; easily enough done if the tube is first softened by heating to red and dipping in cold water. File off the end squarely, and drill a No. 70 hole in it; or the nearest size larger, for which you have a drill. Bend the end over at right angles, drill a suitable hole in the large tube about 1 in. from the end, insert the bend, and silver-solder it. The jet must stand straight up in the middle of the tube.

The next requirement is a balancing chamber, to keep the stream of air steady. This may be simply a tin can, soldered up airtight; an old coffee or cocoa tin does fine. Drill two holes on opposite sides, close to the top; and in them, solder two pieces of tube, same size as the blower tube in the extension pipe. The third item is a tyre pump; a motor pump is best, but a cycle-pump will do at a pinch, though it takes longer to get up steam. The pump is connected to one of the tubes in the can, and the other tube in the can is connected to the blower tube by a piece of stout rubber pipe. A cycle-pump connection may be used if desired, adapters for the screwed ends being made from discarded cycle valves silver-soldered to the pipes. The whole outfit is shown in the diagram.

How to Get Up Steam

Fill the boiler until the gauge glass shows three parts full, either by taking out the safety-valve on the larger boiler and pouring water in, or by using the engine's own hand-pump. After the first run, there should always be enough water left in the boiler for the next. All the moving parts of the engine should be oiled with any good brand of lubricating oil, but it should not be too thick; I use "Etna heavy medium," a

product of the Vacuum Oil Company, having bought a five-gallon drum of it some years ago for my shop machinery. The cylinder lubricator should be three parts filled with a good brand of cylinder oil suitable for superheated steam; Cyltal 80S, Vacuum 600W, or similar. Thin oils are useless; the hot steam will just vaporise them. Put the extension tube in the chimney of the engine; and for the first two or three runs, it would be a help to get somebody to operate the pump. If you are a married man with interested kiddies, that difficulty will soon be solved! Either wood or charcoal can be used for starting the fire; I use charcoal broken up into pieces about $\frac{1}{2}$ in. long, with the dust sifted out. Either small sticks or blocks of wood will do, if charcoal isn't available. Put the charcoal or wood in a tin lid, and pour paraffin over it. Shovel some into the firebox, enough to well cover the bars; start the pump going, and throw in a lighted match. The whole lot will catch alight and start roaring merrily. Add some more wood or charcoal, and shut the door for a minute or so. Fill the side tanks, if not already done, with clean water.

The coal should be broken up to the size of peas, and the dust sifted out. Best results are obtained with Welsh steam coal, anthracite, or a mixture of the two; house coal is of very little use. Not only does it make a lot of smoke, and leave a tarry deposit in the tubes, but it hasn't sufficient "therms" in it, to generate steam fast enough for the engine to work at full power. As soon as the wood or charcoal has caught alight all over, and is glowing red, pop on about four shovelfuls of coal and shut the door again. In three or four minutes, depending on how vigorously the air pump is operated, there will be enough steam to work the engine's own blower. Open the valve a little, and remove the extension tube. By this time, the charcoal or wood will probably be all burnt away, and the coal will have settled on the firebars; if so, give her another couple of shovelfuls. You will now see the needle of the steam gauge "walking up"; and in a minute or so, the safety valve will lift.

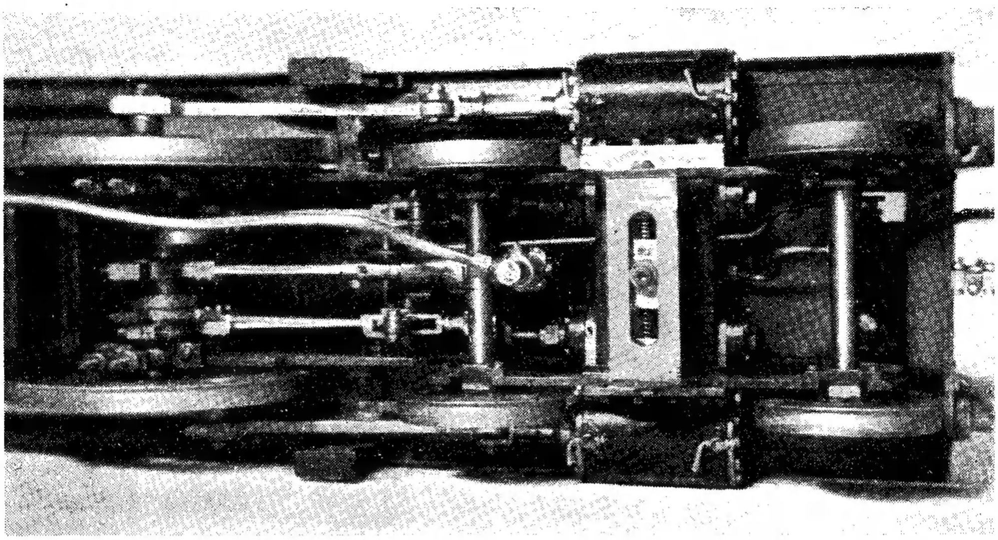
The First Run

Put the lever in full forward gear; or if she has loose eccentrics, move the engine forward one turn, then open the regulator steadily. Steam going into cold cylinders will condense into water, and this may become trapped between piston and cylinder cover, locking the wheels. If this happens, shut the regulator and move the engine by hand for a turn or so. The water will force the slide-valves off their seatings, and escape up the blast pipe, so don't put your face over the chimney top, or you'll be well and truly christened. The slide valves will not lift with the regulator open, as the steam pressure on them will hold them down. When the engine wheels turn freely again, open the regulator once more. If the wheels still lock, ditto repeato above; but the third time she should be O.K. as the cylinders should then be hot enough. Now be careful, for if you open up too much, the engine will dart away from you like a shot from a gun-barrel; and if she *does*, you can say good-bye to all your patient endeavours, for she will run off the road, and crash. Open up steadily, and she will behave herself like a well-bred locomotive should. If you have only a short straight line, let her run up and down, without any load, two or three times; if a continuous track, let her do a complete circuit. Warning—as she will be probably blowing off all the time, as well as using steam for running, look at the gauge glass; and if the water is below half-a-glass, put a drop in with the hand-pump. Try to remember always to shut the blower-valve after opening the regulator, and to open the blower-valve before shutting the regulator. There is no need to have the blower on when the engine is running; it only wastes steam, also you cannot hear the beats properly. They should be sharp and snappy, with no trace of a wheeze in between.

How to Fire and Drive

There are tricks in every trade, and the enginemen's trade is no exception, whatever the size of the locomotive; also what goes for the big one, goes for the little one as well. Couple up to your passenger car; and as *Tich* doesn't carry any coal on board, take some in a tin box on the front end of your car. Put a couple of shovelfuls of coal on before starting; take your seat, and open up steadily. *Don't tap at the handle*; hold it like a full-size driver does, so as to keep full control. If you are of normal weight, and the car is an eight-wheeler on ball-bearings (I'll have something to say about cars in "Beginners' Corner" very shortly, all being well) little *Tich* will treat you as the equivalent of a bag of feathers, and move off with all the vim and vigour of the full-size article, with loud even puffs from the chimney, and will begin to blow off almost immediately; so close the by-pass valve, and if she has the full valve-gear, bring the lever back next to middle, making certain that the latch drops into the correct notch in the quadrant. The beats will ease off a bit, and she will settle down to a steady pull. Speed is then controlled by the regulator. Watch the gauge glass, and when the water rises to three parts of a glass, open the by-pass valve a little. This valve should be regulated, as near as possible, to keep the level in the boiler as constant as possible; you'll find the correct amount of opening, after two or three runs.

Recollect that you are a "one-man crew," and have to fire as well as drive; so watch the fire. Whatever else you do, *don't let it get too low*, because such a weeny fire will soon die out if any holes form in it. At the same time, don't fill the box right up to the door, or you will choke the fire. As soon as the engine is well under way, take a look at the fire; the bit that you put on just before starting, should now be well alight. If parts of it are still black, not fully incandescent, shut the door for a minute or so. You'll soon know when it is thoroughly alight, as the safety-valves will lift. That is the right time to put a bit more on. Most beginners have the impression that the proper time to make up the fire, is when the steam begins to go down; they never made a bigger mistake! When the safety-valve blows off is the right time



The "works" of Mr. W. S. Van Brocklin's "Tilly"

to fire; and the motto is "little and often." When you have about an inch depth, or a little less, depending on the quality of the coal, try to keep it at that. A sprinkling of fresh coal on top of an incandescent mass, will not reduce the steam pressure; and the residue, falling through the bars into the ashpan, will lower the level, so that the fire has burned down slightly by the time the next bit goes on. This brings up the level again, and literally "keeps the pot boiling." If you let the fire down too much, and then smother the top with raw coal, pressure will fall rapidly. If this is done, as frequently happens with inexperienced firing, the best way to recover pressure is to drop the lever a notch or so, making the engine puff harder, and open the by-pass fully, so that no cold water goes into the boiler for a minute or so. The stronger blast will rapidly light up the coal, and the steam pressure will recover much more quickly without the feed; but as soon as full pressure returns, shut the by-pass until the water level is restored, then regulate as before, and don't let the fire down again!

The above instructions apply to non-stop running on a continuous line. If only a straight line is available, don't fire on the run; make up the fire when stopping at the end, always remembering to put a bit more on when the fire is fully incandescent, and the safety-valve blowing off. As more steam will be used in constantly starting and stopping, than on continuous running, the by-pass valve will probably have to be closed all the time. When finishing the run, let the fire burn right down; don't run until steam is all gone, but shut down when pressure has dropped to about 30 lb. Dump the remains of the fire by pulling out the dump pin, and wipe off any oil splashes, etc., while the engine is still hot. Don't leave the blower valve open when the engine is cooling down, or ash and grit might choke the nozzle when the steam is all gone, and the vacuum in the boiler starts sucking in air through any available opening.

For the Bookshelf

The Bulleid Pacifics of the Southern Region, by Cecil J. Allen and S. C. Townroe. (London: Ian Allan Ltd.) 80 pages, size 7½ in. by 10 in. Price 10s. 6d.

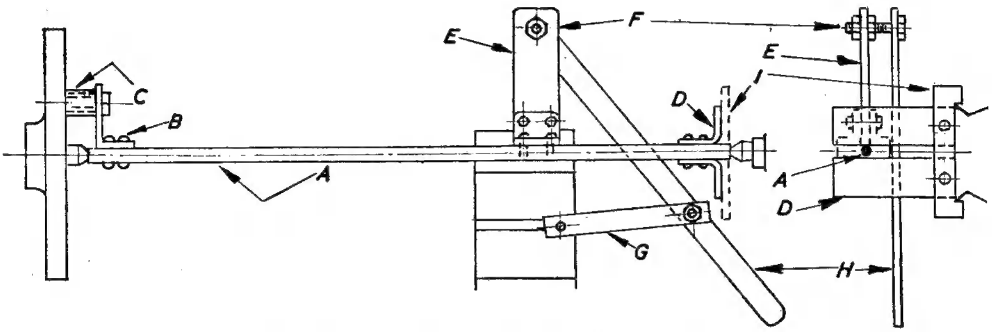
This book tells the story of the inception, building and operation of the 140 4-6-2 type locomotives designed by Mr. O. V. S. Bulleid for the Southern Railway. There are four main divisions of the text, which is written in a clear, concise style easily assimilated by any reader interested in the subject. Mr. Bulleid has contributed the Foreword.

The illustrations consist, for the most part, of magnificent photographic studies of the engines in action; but there is a rather crude coloured plate to serve as a frontispiece. Diagrams of the three main classes of these engines, and two cab layouts are included in two of the four appendices; the others provide principal dimensions, numbers, names and building dates. Several logs of runs, some of them brilliant to the last degree, are included in the chapters dealing with the performance of these engines.

A Cheap Lathe Planing Accessory

by C. Claxton

TO some of us the possession of a lathe is the be-all and end-all of the amateur engineer's workshop, so far as machinery equipment is concerned, and I am no exception. As I wish to cut the flutes on two $8\frac{1}{2}$ in. connecting-rods, to say nothing of the side-rods (coupling-rods to you), and the combined travel of the top and bottom slides across the bed, going in the same direction, of course, is only 4 in., I cast around for some way to overcome the difficulty. Hunting in my scrapbox (all good engineers have one of these), I came across a flat bar of iron, and as I looked at it, the idea occurred to me (not as quickly as I am writing this, perhaps), that with a few excrescences added, I might be able to turn it into a detachable planing accessory for my lathe, and this is how I did it.



Plan and end view of the lathe planing accessory

Materials

Any piece of flat iron or steel bar of a suitable length and not too wide will do; this is bar *A* on plan. Trim up both ends with the file, carefully mark out, centre, and Slocomb drill fair-sized holes, as this component relies on the lathe centres to hold it. In case this meets the eye of some tyro whose knowledge of the subject is not sufficient to write home about, mount the bar flat on the top slide, pack up to centre height, tighten toolpost clamp, then release leadscrew nut and feed up with the tailstock, substituting a fluted centre for the plain one to avoid damaging the point. Swap ends and repeat. Next, an angle-iron bracket, found in the same box, was riveted on at *B*, and bolted to the faceplate at *C*, with a short length of gas barrel threaded on to take the strain. Two pieces of angle-iron riveted on at *D,D*, with their extremities resting squarely down on the bed, are for locating purposes, and help to steady the bar. Another piece of old iron shaped to grip the bed at *I*, and bolted to the feet of *D,D*, gives added stability if not refinement, to the job; shown on end view.

Now to those unlucky people whose lathe has no rack, which is the motive power I am relying on, I have added the extra ingredients. *E* is a short flat bar riveted on the back of bar *A*, with two pieces of angle countersinking the heads on the front. At *F*, a bolt fastened on the underside with two nuts, one each side, to hold and adjust same for length. This is the fulcrum pin for lever *H*, which, like the Scotch marine engineer, gangs below. A tee-bolt nutted down the middle slot of bottom slide, with the remainder of the thread removed, allows link *G* to be slipped on, and with another bolt at the opposite end, connected to lever.

Operation

You will probably have come to the conclusion by now, that my scrapbox is an old iron yard. However, to continue, place the planer in position between centres, lock the back gears, tailstock barrel, and tighten up bolt at *C*. Fix top slide vertically to bottom slide with the angle-plate, and take light cuts along the face of bar *A*, to true it up for a sufficient length and width as will be actually required for the work in hand, finally scribing a line at centre height along the bar. Coupling-rods located on this line by bolts through their crankpin holes and the bar, can now be fluted, and machined along their length on three sides with one setting.

This completes the planer, and, I hope, it will be appreciated that the undoing of one bolt at *C* enables the contrivance to be taken off, and put out of sight. And don't forget to paint over the rust before anyone sees it!

PRACTICAL LETTERS

Prevention of Precipitation of Moisture

DEAR SIR,—May I add a little to the large amount which you have already printed on the above subject in your admirable paper.

I offer for test by your readers the result of a trial which I have carried out throughout last winter with complete success.

It would be well first to recount a few facts with which I think most people will agree.

1. A steel surface perfectly free from grease or any protective coating will slowly rust when kept in the best ordinary location (excluding storage under special conditions, e.g. in a desiccator).

2. A slight film of non-corrosive oil will give good protection stored under good conditions, i.e. where precipitation of moisture does not occur, the relative humidity is reasonable and acidic vapours are almost absent.

3. Oil gives very little protection where precipitation does occur.

4. Pure water alone does not cause rusting. Carbon dioxide (which is always present) and other soluble acidic gases are necessary.

5. For precipitation to occur the following conditions are necessary :—

(*a*) Moist air (80 per cent to 100 per cent. relative humidity is quite common in rooms and workshops in this country). Spring is the driest season of the year.

(*b*) A rapid rise in temperature of this air (note warm air holds more water vapour per cu. ft. than cold air).

(*c*) A piece of metal. The size for precipitation to occur will depend on the relative humidity of (*a*) and the rate of change of (*b*). In most workshops these conditions occur very frequently and the usual way of combating them is the prevention of (*b*). Practically all the methods put forward so far have involved heating the air of the workshop so that the temperature is reasonably constant, and is likely to be less influenced by external effects. As most amateurs know this is very costly and is ill afforded.

Another method is coating large tools with grease, wax, etc., but arguing from the above it does not prevent precipitation but it does give an added degree of protection from rust. However, it is time consuming and messy and should only be resorted to when the workshop will be out of use for a considerable period.

I have found that on my lathe, precipitation, which before was inevitable sooner or later, was prevented by covering with a light oilskin cloth, no attempt being made to get close contact between the metal and the cloth and burning a 40 W electric lamp under the "hood." This method (tested for 9 months) has been completely successful in a corrugated iron workshop with no heating except when occupied. The lamp is on every hour of the day and night except when the lathe is in use (about twice a week). My other tools are stored in a large old wooden cupboard which is also "warmed" day and night by a 40 W lamp. Again no precipitation has occurred since the introduction of the lamp.

The cost calculated on electricity at 1d. per unit and including the replacement of lamps works out roughly at 1s. 6d. per week which seems to me to be a reasonable sum to pay for the protection of £100 of equipment. I may add that I use oil on all bare steel surfaces in order to prevent corrosion from perspiration as well as a lubricant.

The above subject could be considerably elaborated by qualified people but I offer the above result for consideration by your readers. I do not propose to explain why precipitation has been prevented by using the above method—a little thought will soon provide the answer.

Yours faithfully,

Brynmenin, Glam. A. M. SCOTT.

Camera Construction

DEAR SIR,—I am always one of the first to give credit to those who attempt to accomplish something on their own initiative, and for this reason alone full marks must go to Mr. Todd for his efforts in designing a camera for workshop photography (THE MODEL ENGINEER, June 28th to July 5th, 1951). However, as this is his first attempt it is by no means to his discredit, that certain weaknesses of constructional methods are apparent. I hope therefore that he will not mind if an "old hand" does a little criticising.

But let me start off with a word of praise. Broadly speaking Mr. Todd has the right idea on the best type of camera for this work, and he also appreciates the necessity for complete rigidity of the camera as a whole. The points in which to my mind the design is weak are more a matter of detail, but I think Mr. Todd will agree that even minor points can cause a lot of irritation in practice, especially if they tend to multiply themselves.

As all criticisms are to some degree personal, I leave it to the reader to discard those remarks with which he does not agree.

To begin with, I always like simplicity of design provided it does not interfere with efficiency. For this reason I should be inclined to dispense with the swivelling motion, operating from the slides to the front and back U-shaped members. The only practical use this seems to have is to increase the bellows extension. If this were necessary I should increase the length of the bed by two or three inches. The next thing I should get rid of would be the cross-slide (Part 17). In the first place, 1 in. cross is much too limited, and in the second place as both U-members are pivoted in their centres, cross movement can be obtained by swinging both front and back in the same direction and to the same degree.

To obviate having to tilt the camera on its side when taking horizontal shots I should prefer to fit a reversing back. Otherwise the centre of gravity of the camera in this position would demand a rather cumbersome tripod to keep it

rigid. Another point is that the shearing strain between the key and its groove might tend towards wear of the latter.

I am not too happy about the cotter lock which clamps the slides to the base bar. The base bar is, after all, in this case, a bearing surface and anything which tends to deform or mark it will interfere with the smoothness of its operation. If it is still intended to turn the camera on its side I would certainly do away with the forked bearings carrying the lens panel and back, because when these are loosened to adjust for swing the whole assembly is liable to fall out, and bouncing a lens on the floor does not do the floor much good!

But in any case I think I would prefer a reamered bearing to prevent any tendency of the parts riding when tightened up.

Mr. Todd remarks that he has not yet detailed out the rising front, but, in fact, he already has one! All he has to do is to tilt up the base bar, set the lens panel and back both vertical and, *voila*!

My objections to having a focussing device in the form of a screw thread is solely on the grounds of slowness of operation. I like to be able to flick the lens backwards and forwards with one hand while slowly swinging and tilting the lens panel with the other in order to determine the plane of maximum coverage of the lens. This would be much more tedious with a screw thread which must be turned ten complete revolutions to move the lens 1 in.

I hope Mr. Todd will not think my criticisms too harsh, but as I pointed out earlier, much is due to personal preference; nevertheless, the camera as it stands should be capable of producing good work and I leave it to the designer to decide whether or not he considers my remarks sufficiently justified to warrant their incorporation in his final design.

Yours faithfully,

Mansfield. H. ARTHUR CLUES.

"Maudslay Table Engine"

DEAR SIR,—The photograph on the cover of August 16th issue is very interesting indeed, and should make a fine subject for a model, say, 2 in. stroke by 1 in. bore, with flywheel approximately 6 in. diameter; the total height coming out somewhere about 12 in.

There are two or three points, however, upon which interested readers might like further information.

Is that governor authentic, and if so, is it in its original position? As shown, the base or gear housing doesn't seem to fair-up with the table—or should it be "entablature"—nor does the throttle gear appear to be complete. The sheave is present under the lower arms, but no yoke or lever, nor visible connection with steam supply.

The entablature legs—are these one solid casting or are they four sets of two, mitred at corners, with fixing lugs inside? The splayed feet seem to indicate separate pairs of legs.

Maybe in the event of others beside myself evincing an inordinate interest in this engine, the Sutton Model Engineering Club might care to give some further information, and let us have another view of the job. The cylinder, in these days of castings shortage, should present little difficulty to those who delight in building-up, as, being separate from steam chest, could be satisfactorily silver-soldered from a bronze/gunmetal bush, two flanges, a middle moulded band and a couple of rectangular plates for steam-way facings. Using discarded bushings, however, I should like to point out that most such things have a "midships" oil hole in the side, which same will have to be plugged with fine thread bronze plug and silver-soldered at the same time as middle band and flanges. Lay-shaft bushings from auto gear-boxes are often minus this hole, though again, generally less than 1 in. diameter inside—in fact, nearer $\frac{3}{4}$ in. The side columns may be planed-up cum filed from $\frac{1}{4}$ in. or $\frac{3}{8}$ in. steel flats (and that's likely to be "*verboten*" soon) and should prove an interesting job in itself. In fact, as I see it, it's about the most suitable subject for a really engineer-made job that I've seen in years.

Don't you think, sir, it will do us all a power of good to have to get down to it and really *make* our models instead of just buying castings, rubbing 'em with a file and screwing 'em together?

Personally, I've never liked castings. A good cut-from-solid job, be it con.-rod or crank or steam chest or other component for which this procedure is satisfactory, has always intrigued me—I have lots—just made for the innate pleasure of doing 'em that way. They'll be incorporated in engines—one day, if I live long enough.

Built-up brass patterns are another failing of mine. If I do want a set of cylinder castings or something "good" I make a brass pattern—comes out cleaner than wood and is easier to "glue" together—what's more, it doesn't split at the last stage.

So there we are, sir, but it's in the hope of encouraging more interest in "tool-usage-in excelsis" amongst us, for rarely have I seen a more fitting subject than the one in question.

I'm not saying I'm going to do likewise but the temptation is very strong. Those many kind people who dig me out during the summer months know how little time I get for models, though they also know where my main interest lies.

Yours faithfully,

Penzance. HERBERT J. DYER.

Oscillating Steam Winches

DEAR SIR,—I was interested in Mr. R. Taylor's letter in the issue of September 6th, 1951. I remember during the late war seeing an oscillating horizontal steam winch in a mining contractor's yard at Coundon near Bishop Auckland, County Durham. It had two large cylinders with separate cranks and control valve with the three positions: forward, stop and reverse. It was in good working order and the owner spoke very highly of its performance and said it was in regular use.

Possibly some of the members of the Bishop Auckland Society know of this engine?

Yours faithfully,

Harrogate. C. B. GUITE.